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Sound Infrastructures of the German Democratic Republic:
Renewing Sound Technology during State Socialism

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I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where stated otherwise by reference or acknowledgment, the work presented is entirely my own.

Abstract and Lay Summary of Thesis

This thesis analyses the German Democratic Republic's (GDR) efforts to create and maintain modern sound technology infrastructures to deliver culture to its citizens. Analyses of GDR heavy and hi-tech industries and the state's cultural policies have been key to understanding how state socialism functioned and how it interacted with the world beyond its borders. However, while the intersection of the technological and cultural spheres was no less integral to state socialism, it has been less well served in academic discourse. Tracking the development and application of sound technology in the GDR from the immediate post-war period to the state's eventual demise uncovers revealing narratives of perpetual change across the GDR's nationalised broadcasting and recording industries, provoked by unique political, economic and technological convergences.

The technological infrastructures that supported cultural media in the GDR were initially restored from the remnants of pre-war structures, but technological developments in the West brought rapid transformation.The mid- to late-1950s were particularly convulsive as the GDR weathered the loss of its main radio broadcasting centre to Western encirclement and the gramophone record industry collapsed due to the arrival of the vinyl record. The infrastructures that emerged from this period synthesised established commercial and sound technology practices with new ideological priorities, tempered by material and economic limitations. These new infrastructures had substantial success over their lifetimes, but were also vulnerable to the deficiencies of the wider GDR economy. Interactions between the GDR and both Eastern Bloc and Western sound industries were thus critical to the survival of the GDR's native industries. GDR institutions consistently attempted to negotiate and improve their own capabilities while leveraging their strengths to develop commercial relationships that could compensate for areas of comparative weakness. A period of relative technological stability from the 1960s to the late 1970s led into another period of technological upheaval as microelectronics and digital technologies were integrated into sound technologies. A long-term project to develop digital sound technology confirms many criticisms of the GDR's straitened electronics industry, but also indicates how the GDR had workable plans to maintain its sound infrastructures into the next century.

This thesis uses representative case studies taken from some of the most tumultuous periods of the GDR's existence to demonstrate how ideology and technology became entwined in the GDR's sound infrastructures. It relies on the records and writings of sound technicians and audio institution administrators to relay how well-understood forces in the GDR's history materially impacted diverse areas of sound technology development and implementation. It also demonstrates how the continuous renewal and re-conceiving of sound-related practices, facilities and technologies in the GDR mingled with the state's economic situation, Cold War political factors and socialist ideologies concerning culture and technology to produce unique technical outcomes.

Do mo chlann, Seán, Edel, Meadhbh, Deirdre, agus mo mhuintir ar fad, an tráchtas seo.

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Introduction: Noisy Archives, Quiet Narratives

This thesis has two broad aims: to offer insight on several areas of the GDR's unique audio infrastructures based on primary sources and, by so doing, make a case for the centrality of technical histories to larger narratives. This research was prompted by an interest in discovering how recording technologies and music recording studios in the German Democratic Republic (GDR) developed in the context of the Cold War. These two investigative lenses - the general area of music recording and the particular political, social and geographic context of the GDR - were the guiding lines of pursuit that led an initially narrow-focussed investigation to broaden and engage with several unanticipated but fecund areas of research. Consequently, this study uses five case studies as a basis for engaging with broad patterns that characterised the development of audio technology and infrastructure in the GDR. Each of the case studies offered is compelling in regards to its interactions between technology and wider dynamics within the GDR. The political and strategic significance of a construction like Funkhaus Berlin makes this very clear from the beginning and the following chapters detail repeated intersections between diverse audio technologies and wider GDR and global narratives. Initial assumptions regarding a broad Soviet technological influence on GDR technology and practice were quickly dispelled and a surfeit of research material pertaining to GDR recording and broadcasting led towards much more compelling and byzantine narratives. These narratives deliver several new perspectives on the role of cultural technologies within the GDR's larger history and make the case for cultural technologies as useful lines of enquiry in political and social histories.

A cursory examination of audio technology in the GDR reveals that the state's lifetime aligns in interesting ways with several major technological changes and shifts in audio technology paradigms. These technological timeframes could be used as the basis for an insightful analysis of most developed economies, but the utilisation of technology and culture as oppositional constructs in the broad-fronted Cold War heightened the stakes for sound technology developments and utilisations in the GDR considerably. This intersection of culture and technology also helps make explicit the human element; this is not simply a narrative of technological components and procedures – but of a people and their society and how they used audio technologies to construct their lives. This thesis attempts to enact its recognition of this by placing technological and infrastructural developments within broader historical

narratives and by making a case for the utility of cultural technologies as a point of analysis in wider political narratives.

The intersection of cultural and technological activities carries a specific significance within the context of the GDR; state socialism placed notable emphasis on the role of both in the development of its new society. New media distribution technologies and cheaply-produced "wonder" materials offered a potential basis for creating a shared cultural and economic prosperity ideologically distant from historical modes of wealth-generation. During the GDR's existence, the technological areas emphasised by central government policies varied over time and ranged from plastics and other petrochemicals to consumer electronics and information technologies.[1] Policies in each of these broad areas impacted on how sound technologies were introduced and developed in the GDR. Alongside the GDR's generalised faith in a technological modernism, Germany's high-art cultural heritage supplied a reassuring historical continuity that could bypass to some extent the angst of the Third Reich.[2] As well as providing a sense of cultural stability, this cultural heritage was mobilised for other purposes. Elite classical music performance ensembles within the boundaries of the GDR became essential to the domestic recording industry due to their international reputations and GDR music infrastructures - as will be shown - were developed in ways to efficiently exploit this.

Considering the shared emphasis on technological transformation and cultural aspiration in GDR society, comparatively little investigation has been carried out on the overlapping of these realms – namely GDR cultural sound technologies and infrastructures - and how these contributed to or were influenced by the broader GDR project. The GDR constructed diverse technical infrastructures to deliver culture to its citizens. The maintenance of the technical and functional parity of these infrastructures alongside developing international standards became important for managing both internal and external perceptions of the GDR's ability to function as a modern technological state. These infrastructures underwent several

[1] Dolores L. Augustine, *Red Prometheus : Engineering and Dictatorship in East Germany, 1945-1990* (Cambridge, Mass.: MIT Press, 2007); Raymond G. Stokes, *Constructing Socialism: Technology and Change in East Germany 1945-1990*, Johns Hopkins Studies in the History of Technology (Baltimore; London: Johns Hopkins University Press, 2000).
[2] Elizabeth Janik, *Recomposing German Music : Politics and Tradition in Cold War Berlin* (Leiden: Brill, 2005); Alan L. Nothnagle, *Building the East German Myth: Historical Mythology and Youth Propaganda in the German Democratic Republic, 1945-1989*, Social History, Popular Culture, and Politics in Germany (Ann Arbor: University of Michigan Press, 1999); David Monod, *Settling Scores : German Music, Denazification, and the Americans, 1945-1953* (Chapel Hill, N.C. ; London: The University of North Carolina Press, 2005).

cycles of major technological renewal during the GDR period. This creates several opportunities for analysing the capacity of GDR institutions reliant on sound technologies to develop or adopt new technical solutions and practices during various stages of their own progression under state socialism. These technological renewals often align in revealing ways with broader GDR political, industrial and economic contexts. At the centre of many of these infrastructures are various media formats often used as quantitative and qualitative bases for comparison throughout this thesis. This thesis helps to pluralise formation narratives of cultural technologies and media and actively seeks out distinguishing GDR features in these areas, but the various exchanges enabled by compatible media formats even across national and ideological borders were of profound significance to GDR institutions and its citizens. This cultural significance is part of the justification for much of the analysis in this work while the shared compatibility of various media formats used in the GDR and across the world helps validate their use as sources of interpretation.

In the context of the recording industry, the GDR's lifetime almost exactly aligns with the introduction, peak and decline of the vinyl record as the dominant global music format. This thesis will discuss vinyl record production figures in the GDR in Chapter 2 as it offers a convenient material analogy for a complicated narrative of success and failure in cultural mass production over four decades. In electronics, the GDR's bridging of the transitional era of valve- to transistor-based electronics during the 1960s was one of its most important technological successes and helped to fuel productive research and development in audio and information technology fields. The GDR's attempts to maintain pace with the rapid progressions of digital technology during the 1980s were seized on by its audio institutions as another opportunity to revitalise domestic audio equipment, but the limitations of the broader GDR electronics industry constrained progressive research efforts in audio technology areas. The discussion in Chapter 5 of a research and development project in the latter days of the GDR will bring the impact of these constraints into sharp relief. These examples also combine to elucidate conflicting impulses within the GDR. While the GDR political and economic project consistently strived towards the creation of a closed system largely independent of Western influence, cultural technologies were consistent enablers of a degree of pluralism within this. In spite of the regular characterisation of Western cultural imports as an ideological threat and intermittent efforts to stem their influx, the GDR's own audio infrastructures -

developing in tandem with Western-led technological paradigms - always remained compatible with Western output and served as a conduit for the influx of Western media and culture.

As is habitual in GDR studies, West Germany frequently serves as an important control and point of comparison for a period during which both German states were attempting to rebuild and reconceptualise their societies and industries. This thesis also makes repeated and extensive comparisons between situations and technologies in the GDR with contrasting or coincident examples in other – mostly Western – contexts. Such contextualisation is essential to deciphering the original research contained within this thesis and can at times allow some degree of assessment of the relative success of various GDR efforts. The simplistic labelling of technological or other projects as "successes" or "failures" is problematic both in historical and contemporary circumstances, but such estimations are additionally fraught in the case of the GDR given the acrimonious circumstances of its existence. This thesis offers a collection of several narratives across a range of cultural technological endeavours that problematise to varying degrees persistent characterisations of the GDR as technologically deficient. The case studies of this research also offer opportunities for thinking about technology itself - Paul Edwards has emphasised how deterministic views of technological narratives disappear in micro-histories and this work should be observed to offer several confirmations of that.[3]

The contrasting fortunes of the GDR's record industry during the 1950s and the 1970s - discussed in Chapter 2 - offer a pertinent example of the challenges in making sweeping qualitative assessments. Difficulties introducing vinyl record production to the GDR during the late-1950s were augmented by a dysfunctional administrative system following the reorganisation of East German industry and the GDR's national record industry during this period suffered in comparison with the activities and output of the major West German record companies. However, such direct comparisons elide recognition of the very different paths the reconstruction of sound technology infrastructures took in West Germany and the GDR. East Germany initially had possession of critical pre-war broadcasting infrastructure in Berlin, until this was acrimoniously disentangled from its grip during the late 1940s and early 1950s. However, during the same period, practically all of Germany's pre-war record industry decamped to West Germany. This flight of the pre-war German record industry from East

[3] Paul Edwards, 'Infrastructure and Modernity: Force, Time, and Social Organization in the History of Sociotechnical Systems', in *Modernity and Technology* (Cambridge; London: MIT Press, 2003), 10.

German territories and the degree to which the GDR created an entirely new record industry infrastructure within a highly fluid administrative and commercial context must thus form part of any assessment. Even still, the purpose of the comparative assessments in this thesis are not to essentialise circumstances in the GDR but to tease out new insights into an important period. Further examples of problematising narratives are attempts by GDR research institutions to push the envelope of sound reinforcement approaches and sound distribution systems during the late-1970s and 1980s. The GDR had notable successes in these areas - particularly in the service of new forms of performance venue discussed in Chapter 4 - and the resultant systems and technologies made largely unrecognised contributions to sound reinforcement in Europe and beyond both during and after the GDR-period.

Although the GDR encountered many difficulties across diverse areas of technology and industry, it consistently pursued research and development activities in audio technology areas and maintained a capacity to innovate that resulted in unique technologies, even as its economic and industrial capabilities faltered. The degree to which GDR institutions could handle the technological cycles that brought new professional and consumer formats and disruptive changes in practice depended on the period, the characteristics of the particular technology and the latitude given to technical experts and administrators to negotiate restrictive circumstances. The GDR maintained independent research processes, but also adopted many internationally-developed technologies and consensus formats. The adoption of consensus technologies was not a wholly passive process; the introduction of FM broadcasting in the 1950s had major strategic implications for GDR broadcasting and became an extension of existing Cold War electronic fronts. Later, less contentious technologies were regularly adapted or reconceived by GDR technicians and engineers to better meet their own circumstances and requirements. The GDR also consistently engaged with the foreign technology developers and suppliers. International collaborations were consistently critical to the progression of the GDR's audio infrastructures; diverse exchanges of material, technology and knowledge between GDR audio institutions and both Eastern and Western European commercial and academic collaborators were a lesser or greater feature of nearly every period and major development. Technological developments and foreign collaboration had a particularly profound shaping influence on the GDR's record industry. Administrators of the GDR's state record company financed improvements to the domestic record manufacturing and recording infrastructure over a period of decades by adapting the company to service

international record licensing deals, a source of income greatly enabled by post-war improvements made in the US to Germany's magnetic tape recording innovations. The profound influence of this bi-directional technological exchange remains only partially investigated, but is raised within this thesis.

Even aside from areas of cultural and technological intersection, considerable scope for traditional historical investigation still remains in relation to many of the GDR's media and music institutions and how these organisations negotiated material and technical challenges in the political and economic contexts of post-war Europe and industrial reorganisation in the GDR. This study attempts to contribute to both of these areas by focussing on original research that articulates the records and observations of technicians and administrators directly involved with sound technology institutions. This thesis is informed by the disciplines of acoustic science, sound studies, sociology and infrastructure studies in the pursuit of a holistic analysis of the themes raised by the research material, without being rigidly situated within the techniques and procedures. The overall intention is to draw out and discuss illuminating confluences of pre-war technological structures, technical development processes and political and economic factors, that together combined to shape unique technological forms and infrastructures in the GDR.

This thesis seeks to demonstrate that the GDR's audio institutions successfully assimilated most of the major audio technologies unveiled during its existence on a relatively regularised schedule and that they had active and viable technical procurement and advancement plans that extended well beyond the unanticipated fall of the Berlin Wall. Together, the case studies of this thesis seek to interrogate how GDR audio institutions combined straight-forward technical adoption paths with bespoke adaptation and independent development processes to sustain sound technology infrastructures in ways that contribute some new perspectives on wider GDR industry. These case studies also suggest that the GDR was able to innovate in myriad successful ways to adapt international technologies and conceptual developments to its own particular ideological and material circumstances. These findings are likely to have application for those engaging with the GDR context across various fields of enquiry, but it is hoped that the scope of the technological sample analysed in this work mean it will have utility for a wider readership interested in the overlapping of technology, sound and politics.

0.1 Archival and Primary Sources

The findings of these thesis are predominantly based on primary sources gathered from two research institutions during a six month DAAD-funded research trip to Berlin in 2015: the Deutches Runfunk Archiv (DRA) and the Bundesarchiv at Lichterfelde. These two institutions provided large quantities of material on two separate but interrelated areas of sound infrastructure in the GDR: the national radio broadcaster Rundfunk DDR and the national record company Deutsche Schallplatten. The greatest single influence on the direction of this thesis was the holdings at the DRA on the technical infrastructure and activities of Rundfunk DDR. These largely took the form of documents from Deutsche Post's technical research and development organisation, the Rundfunk und Fernsehtechnisches Zentralamt (RFZ), which was closely involved with Rundfunk DDR. These organisations contributed to the technical development of television broadcasting in the GDR, but the holdings at the DRA and, as a consequence, this thesis, focus predominantly on music recording, radio broadcasting technology and music performance acoustics. The material at the DRA is extensive, extremely diverse and unfortunately not-yet systematically organised; I am grateful to Dr. Jörg-Uwe Fischer of the DRA for the access I was afforded to this material despite this situation. The DRA material consists primarily of technical reports covering a broad spectrum of topics across nearly the whole GDR period. These sources prompted investigation of Rundfunk DDR's broadcast infrastructure, acoustics for recording spaces, the development and adoption of standardised and bespoke audio recording and playback formats, the introduction of transistorised mixing desks, the introduction of digitised mixing desks and the RFZ's belated and escalating involvement with sound reinforcement in the GDR. Apart from a divergence into the narrative of Deutsche Schallplatten, prompted by Bundesarchiv holdings on that organisation, these topics provide the backbone of this thesis. Moulding a wealth of largely untouched primary material into a coherent direction was among the major obstacles in constructing this thesis. The DRA also supplied one of the most useful organising sources for overcoming this and for resolving the primary research material alongside an instructive pre-established narrative. This source is Werner Stankoweit's 1967 Studiotechnik Rundfunk, a technical history that emerged from an internal Rundfunk DDR directive in 1966 to author a

collective institutional history.[4] Although its initial value was its provision of a reference chronology for Rundfunk DDR's technical infrastructure, its ostensibly technical focus nonetheless deviates into more diverse areas and it provided a useful preliminary route into Rundfunk DDR's institutional memory and methods of self-conception. Stankoweit's history is undoubtedly a product of a specific ideological moment and this, in itself, was of immense value for identifying key areas of technological and political focus worth investigating in this thesis. Contemporary GDR print media offered a similar form of insight and corroboration.

The holdings on Deutsche Schallplatten at the Bundesarchiv Lichterfelde are relatively ordered and cover the full span of the GDR-period, along with a smattering of documents that cover the company's activities before its nationalisation in 1953. The greatest contribution of the holdings towards constructing a solid narrative are the near-complete annual reports. These altered in form and title over time, but generally they became increasingly codified and detailed, supplying increasingly extensive figures across diverse categories of production, record distribution, genre distribution, licensing, income, as well as employment figures and employee social programmes. Approaching these reports with little expectation or prejudice was rewarded by the steady emergence of clear and impactful narratives in the record company's history across several highly integrated areas of the company's business model. While my reading and annotation of these documents heavily prioritised technical discussions, pervasive narratives relating to musical genre distribution and international licensing readily emerged despite this emphasis. Only some of these numerous strands have been addressed in the final analysis and the Bundesarchiv's holdings on Deutsche Schallplatten require extensive further attention.

Although the trend towards more expansive reports provides a boon for the analysis of Deutsche Schallplatten's later periods, irregular alterations in the reports year-on-year raise occasional problems. The terms and categories used to record different areas of production sometimes become more ambiguous and thus difficult to compare directly with other years; occasionally regular categories are absent in one report before returning the following year. The largest deviation of this type to impact this thesis is a shortage of unambiguous vinyl record production figures for the years 1960 to 1970. The most revealing changes in record production

[4]Werner Stankoweit, 'Studiotechnik Rundfunk: Zusammenfassung der Unterlagen über die Entwicklung der Technik des Rundfunks bis 1967, Band I' (Rundfunk DDR, 1967), Deutches Rundfunk Archiv.

in the GDR occur on either side of this date range, but nonetheless this creates an obstacle to interpreting this linking period. In general, the figures used in this thesis as a basis for comparisons across years and decades may not always be fully equivalent, although every effort has been made to use the most unambiguous reports and most readily comparable categories. For example, reported income figures from record sales have, for the most part, been disregarded in the compiling of this analysis and commentary on the expansion and decline of Deutsche Schallplatten activities relies much more upon the reported production figures for a variety of record formats. Some ambiguity remains during some periods due to the pressing of records for Deutsche Schallplatten under contract abroad, but supplementary sources of company correspondence at the Bundesarchiv allow the relative proportion of domestic and production to be broadly determined and improving reporting practices makes this less of a concern for later periods. Contemporary correspondences, often between Deutsche Schallplatten and organs of central government, usually the Ministry for Culture, had additional value. Although these often preserve only one side of a conversation, they also provided important signposts towards some of the major issues the record company faced, corroborating themes suggested by production figures and filling gaps of knowledge and interpretation. They also provide some degree of insight into the character of the company's leadership and the rhetoric and tactics used in the midst of substantial upheaval during the company's insecure early period.

Although this thesis does not attempt to construct a history of individual contributions, the prominence of some names within the primary sources invites preliminary attention. The most consistent of these is the technician and acoustician Gerhard Steinke, who figures to a greater or lesser extent in four of the five chapters of this thesis. Steinke's involvement with Rundfunk DDR began as a radio engineer in Dresden and he quickly assumed a leadership role in the development of audio technology and recording practice in the GDR when he moved to the broadcaster's Berlin headquarters in the early 1950s. Several areas of Steinke's involvement with audio in the GDR and his extensive technical writings are related within the following chapters, but his post-Wende activities are worth noting here. Steinke has been one of the most consistent advocates of the reassessment of GDR sound technology and acoustics and remains active in this role.[5] He has also been critical of the underutilisation of the surviving

[5] Gerhard Steinke, 'Stereo-Ambiofonie und Delta-Stereofonie - zweit Mittel zur Optimierung, denn: Der Raum ist das Kleid der Musik', in *Leben für den guten Ton: Kolloquium anlässlich des 90. Geburtstags von Gerhard Steinke* (VDT Seminar, Berlin: Verband Deutscher Tonmeister, 2012); Ulrich Gutmair, 'Meet Funkhaus's

resources of Rundfunk DDR's redundant infrastructure - particularly its highly-specialised recording spaces - and with Gisela Herzog published the most comprehensive technical description of the GDR's primary radio broadcasting facility, Funkhaus Berlin. This work, *Der Raum ist das Kleid der Musik*, served as an endlessly useful reference point for Rundfunk DDR chronologies but also helped confirm links between recording and performance acoustic design and sound reinforcement designs, which were closely interconnected in the GDR.[6] The only other published work cited in this thesis to demonstrates a similar level of connection to its subject is Wolfgang Ahnert and Frank Steffen's, *Sound Reinforcement Engineering*.[7] Translated into several languages, both Ahnert and Steffen were closely involved with events depicted in the latter chapters of this thesis and their technical commentary on the Delta Stereophony System and associated developments was an important supplement to contemporary sources stored at the DRA. The director of Deutsche Schallplatten, Harri Költzsch, also warrants introduction. His contributions to the record company's survival and later expansion become clear both through his correspondences during contentious periods and the proactive strategies adopted by the company during his lengthy tenure. Other recurring names within the reports of the RFZ are occasionally noted within the thesis for their significance within certain narratives and, in particular, their contributions to often unrecognised GDR-technology narratives that extend beyond the lifetime of the state itself.

The historical period discussed in this thesis is such that many participants in the events described are still active and the original research plan proposed integrating interviews alongside primary documentary research. The volume and quality of primary material uncovered in the primary phase of this project made the pursuit of this avenue impossible, but further investigations should prioritise engagement with these former GDR audio workers. Despite the limitations placed on this work by the absence of reflective commentary from these participants, this thesis does attempt to give some voice to technicians, administrators and other workers of GDR audio institutions through its reliance on the internal documentation and communications that they themselves wrote. The value of this documentation was central to the construction of this thesis, but presented its own challenges. Predominantly taking the form

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Former Head of Sound Technology', Red Bull Music Academy Daily, 10 September 2018, http://daily.redbullmusicacademy.com/2018/09/gerhard-steinke-funkhaus-berlin-sound-technology.

[6] Steinke, 'Stereo-Ambiofonie und Delta-Stereofonie - zweit Mittel zur Optimierung, denn: Der Raum ist das Kleid der Musik'.

[7] Wolfgang Ahnert and Frank Steffen, *Sound Reinforcement Engineering : Fundamentals and Practice* (London: Spon, 1999).

of technical reports, this documentation was primarily intended for an internal specialised audience and the language and subject of these reports rarely strayed into overtly political or ideological territory. Thus, informative interactions between technological processes and broader GDR narratives are wrought from the interpretation of the treatment of equipment, development of practice and funding distribution over extended periods. Articulating a coherent narrative from fragmentary technical and commercial reports while coming from an outside perspective was difficult, but the result offers new insights into how comparatively well-understood forces in the GDR interacted with diverse and less-discussed areas of sound technology development and implementation.

0.2 Methodology

Framing this thesis productively in the light of archival discoveries required several stages of thematic realignment and methodological renewal. Early-stage research proposals envisaged uncovering documentation and conducting interviews pertaining to classical and popular music recording studios in the GDR to develop a picture of recording practice there across a wide range of musical forms and to then contrast this with equipment lists and reported session etiquette from elsewhere. These original intentions recognised to some extent that most focussed writing on recording and studios has usually been centred on specific bands or performance ensembles, notable sessions or recordings or recording studios that have strong associations with notable recordings, performers or scenes. Thus an approach that would look at such practices for an entire record company or country for a defined period would potentially be unique to some degree. Even if this direction had been feasible, it is probable that its execution would have been hampered by a lack of counterbalancing investigations in other national contexts that could then form a solid basis for informative comparison. In any case, the available research materials did not provide sufficient minutiae for such a study and from an early stage my inquiries into GDR broadcasting and recording industry primary sources began to coalesce around emerging questions relating to much more fundamental and broader networks of distribution around technologies, hardware and other physical infrastructure related to recorded sound and its dissemination. These technologies range in complexity from early digital sound hardware to deceptively inelaborate rooms designed to capture or enhance musical performance. While the implicit motivator of this thesis is an interest in the cultural

technologies used by the GDR and a belief that this can tell us something useful about that complicated state and its people, this infrastructural turn – motivated by the research material – required engaging with a broadening set of literature and an interdisciplinary meshing of methodologies. This resulted in a somewhat bespoke amalgamation of qualitative methodologies centred on archival research but taking in discourse and media analysis along with intermittent incursions into ethnography and architectural criticism. This diversity of approaches was a response to the diversity of subjects and themes uncovered and is offered as an initial attempt to divulge and interpret new findings and information.

While this thesis is concerned with diverse forms of sound technologies, it makes only occasional forays into direct discussions of sound or audio. Initially, there was more of a focus on this area. The earliest paper to emerge from this research project focussed on the singer Nina Hagen. Hagen's early career uniquely straddled mainstream success in the very separate GDR and West German commercial contexts.[8] Initially coming to note as a schlager singer in the mid-1970s, she left the GDR and was exposed to punk music while staying in London. She amalgamated that influence with her own inimitable vocal abilities in a new group formed around her in West Berlin, Nina Hagen Band. In an attempt to discern cultural or political subtexts the paper used a comparative analysis of the treatment of voice and space in Hagen's solo and group recordings for the GDR Amiga label and the two albums she made with Nina Hagen Band for CBS. The wide stylistic gap between these two segments of Hagen's career was just one obstacle to a research direction fraught with interpretative challenges. The Deutsche Schallplatten recording catalogue is extensive and extant in various forms and Rundfunk DDR recordings also survive in various media, but the Nina Hagen paper flagged the hazards involved in such an approach, even aside from the difficulties in collating or defining a representative sample. The availability of extensive archival documentation discussing sound technology in various GDR institutional circumstances suggested that an analysis of the discourse related to sound and audio concerns and the material forms that developed around these would prove more fruitful. While I believe the results presented below bear out the validity of this change in direction, it is one of the factors that positions this thesis in its liminal position between several fields of study. There are vulnerabilities in this approach - sections of this thesis contain discussions and critiques of sounds and performances to which

[8] Cormac Ó Callanáin, 'Singing Across the Wall: The Voices of Nina Hagen' (German Studies Association conference, Kansas City, 2014).

I had only indirect access. In the interest of viability I relied and focussed on the discourses that survive around some of the sounds and performances that were produced in the GDR and these provided me with echoes of sufficient resolution to make some valuable findings about those sounds and the people that surrounded them.

For the reasons outlined above, this thesis predominantly contains detailed technical and historical discussions of several technologies and infrastructural systems that have primary or significant cultural applications. Nevertheless, the principal area of interest driving this research is not so much these things in themselves but the people and society that created and used them as part of cultural processes involving the recording and transmission of musical performances. Current discussions on information's continuing trend towards near-ethereality have somewhat disrupted rigid conceptions of "technology" as something inescapably material - physical tools of varying degrees of complexity for accomplishing a specific or broad range of tasks. However, an assumption can remain that technologies emerge conceptually complete as bespoke solutions that respond to articulated social desires or requirements. A more complicated process of co-construction, with a technology's purpose, shape and meaning being shaped by dynamic interactions between social practices, material realities and other factors better reflects the understanding of technology present in this thesis.[9] The "recording studio" - a technology created at a specific intersection of technical, cultural and social practices - was the intuitive entry point to this framing. A central construct in the formation of this research project, it also served as a methodological control that assisted in applying this understanding to the very different technologies, systems and contexts that emerged in the course of this research.

The degree of attention and analysis technology receives and the extent to which a particular technology is centred or recognised as part of a larger social process can swing between extremes. This may be due in part to the multitudinous roles and forms of technologies throughout societies and their tendency to recede from collective awareness as they assume ubiquity. This has revealing analogies in the use of technology for cultural performance where, depending on the context, technological components may be shrouded for reasons of aesthetics or historicity and their contribution excluded from general histories. Conversely, some technologies with cultural applications have been itemised and fetishized. A small number of

[9] Jonathan Sterne, 'Bourdieu, Technique And Technology', *Cultural Studies* 17, no. 3–4 (2003): 390.

recording studios and the aura that has developed around select mixing desks and microphones (but other essential recording equipment far less often) provide some good instances of this. Such examples can provide useful signposts to technologies that have crossed a threshold from a specialised functionality to an acknowledgement of significance in a more general consciousness. However, placing them as key to historical or cultural narratives in isolation from the wider technical networks and sophisticated systems of social organisation in which they are embedded is a problematic omission.[10] Whatever the specific capabilities or unique attributes of any single technology, it is the fact that any meaning attributed to a technology is co-created by the interaction of its makers, users and the technology itself that allows an investigation like this thesis to have an extended value.[11] This thesis attempts to demonstrate the benefits of including technical and technological factors in cultural analysis while recognising the pitfalls of seeking answers from inanimate implements without considering wider pictures.

Broadening the scope of contextualisation was a key development for interpreting the material of this research project. Thinking of a recording studio as a revealing example of dynamic cultural, political and technological intersections was one of the starting points for this study and initiating queries about sound technology and social interactions remain in this final version. However, these have been applied across a more extensive set of circumstances than originally anticipated - suggested and enabled by archival sources. Archives can transmit their own biases on where attention should be focussed, but in this instance they instigated the survey of a wider sample of interconnected national audio institutions. This provided a much larger cross section of circumstances for scrutinising if and how the specific circumstances of the GDR emerged at various technological and cultural crossovers. Recording studios thus remain a feature of this thesis, but more often as just one component within a larger set of systems and institutions. Engaging with the relationships between these symbiotically intertwined GDR entities constructed a wide field of view that was outside the relatively narrow scope of the original research proposal. A search for patterns amongst a gamut of unordered research material united mostly through their shared connections to large technical media systems led to the slow adoption of an approach somewhat akin to what Lisa Parks describes

[10] Brian Larkin, 'The Politics and Poetics of Infrastructure', *Annual Review of Anthropology* 42, no. 1 (21 October 2013): 330; Sterne, 'Bourdieu, Technique And Technology', 370, 375.
[11] Sterne, 'Bourdieu, Technique And Technology', 374.

as an "infrastructural disposition".[12] This thesis deals with several different areas of technology and with some specific and named technologies, but few of these have much significance in isolation from the systems and networks within which they operated and contributed to. This work is entitled "Sound Infrastructures". This was adopted initially as a title of convenience for grouping the relatively diverse range of topics covered, ranging between broadcast networks, music recording, record pressing, concert hall acoustics, sound reinforcement and research and development procedures for sound technologies. However, the investigations made in this thesis fit well alongside recent work in the broadening field of critical infrastructure studies and other material turns in the humanities.

The term or concept of infrastructure as it is commonly understood and used today derives from terminology developed during the expansion and systemisation of permanent military installations during the early 20th century.[13] It is broadly describable as a network of systems that connect people, materials, information or other things across distance.[14] Using infrastructure as a frame becomes increasingly conceptually useful as technological hardwares become more diffuse and interconnected and helpfully captures the duality of systems which are often material and highly visible, but also frequently to some extent intangible or unobserved, often mechanised, but also heavily dependent on people for functionality and meaning.[15] Increasingly relevant when critiquing the complex layers of intervention by technology across society, critical work on a range of widely varying infrastructural systems in the last decade or so has indicated the interpretative value that can be drawn by interrogating mundane or spectacular collections of technologies from this standpoint.[16] The ubiquity of infrastructures in society is demonstrated by how critiques incorporating this approach display similar levels of applicability to understanding the still-functioning redistributive powers of Victorian sewer works, the implied social promise of road construction or the still-emerging force-amplifying powers of social media.[17]

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[12] Lisa Parks, 'Stuff You Can Kick: Toward a Theory of Media Infrastructures', in *Between Humanities and the Digital*, ed. Patrik Svensson and David Theo Goldberg (Cambridge: The MIT Press, 2015), 357.
[13] Parks, 355.
[14] Parks, 355; John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago: University of Chicago Press, 2015), 31; Larkin, 'The Politics and Poetics of Infrastructure', 327.
[15] Larkin, 'The Politics and Poetics of Infrastructure', 329.
[16] Penny Harvey and Hannah Knox, 'The Enchantments of Infrastructure', *Mobilities* 7, no. 4 (2012): 522; Larkin, 'The Politics and Poetics of Infrastructure', 327–29; Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Durham NC: Duke University Press, 2003).
[17] Susan Leigh Star, 'The Ethnography of Infrastructure', *American Behavioral Scientist* 43, no. 3 (1999): 378; Harvey and Knox, 'The Enchantments of Infrastructure', 522; Peters, *The Marvelous Clouds*, 31.

All but the most informal of infrastructures require substantial capital and organisation to construct, making them highly interwoven with associations and expectations a populace might have for a state.[18] Indeed, terms for connecting or shared material forms or systems that precede the coinage of infrastructure - such as public works or municipal works - capture some sense of that involvement of the state, even if they do not hint as effectively at the underlying complexity associated with a developed infrastructure.[19] As well as making better allowance for the complexity and interconnectedness of technical systems, infrastructure also "captures something about the rhythms and rules of modern institutional life".[20] Infrastructure describes not only timetables and building standards but also very human elements of collective constructs that "can take on fetish-like aspects that sometimes can be wholly autonomous from their technical function".[21] This dualistic element of infrastructure as a critical tool helps return technological discussions to the humanities and seems particularly suited to unravelling the intricacies of the GDR's techno-socialist tendencies. While it is relatively recently that there has been a concerted return to the issue of infrastructure as an analytical approach, the timeline of the GDR itself maps well onto an increasing generalised political awareness of the role of infrastructural development as a component of encouraging and meeting societal aspirations during the post-war reconstruction period and beyond.[22] Infrastructural development as a form of social promise is not unique to GDR, similar dynamics were integral to the development of capitalism and Western liberalism.[23] The material forms of capitalism, most especially those of the US, were potent indicators of its ideological vibrancy and forced emulation upon actors that also wished to stake a position in the progression towards modernity.[24] Constructing infrastructural forms suggested by capitalist departures was a practical technical challenge for socialist states, but it was additionally complicated by the requirement of a political conversion to reframe very similar infrastructures within the ideological requirements of state socialism. Drawing attention to the resulting tensions between ideology and technology is to a large extent the mission of this thesis.

[18] Peters, *The Marvelous Clouds*, 31.
[19] Liam Cole Young, 'Innis's Infrastructure: Dirt, Beavers, and Documents in Material Media Theory', *Cultural Politics* 13, no. 2 (2017): 231.
[20] Young, 232.
[21] Larkin, 'The Politics and Poetics of Infrastructure', 328.
[22] Young, 'Innis's Infrastructure', 231.
[23] Larkin, 'The Politics and Poetics of Infrastructure', 333.
[24] Larkin, 332.

The capability of infrastructure to impact the mood of a populace was well recognised by socialist organisers in the GDR and directly experienced by its citizenry. The potent imagery of large-scale technical infrastructure such as the Berlin Fernsehturm is commonplace in depictions of the GDR, but representations of mundane items like a reel of magnetic audio tape could also function indicatively of a reassuring technocracy. Less tangible constructions, such as the acoustic of a recording space – in conjunction with performers and the tools for relaying a performance - may have been complementary sources of reassurance. The proliferation of infrastructures has been described by John Durham Peters as a condition of modernity and the degree to which a society can safely forget about any particular infrastructure might thus be used as a barometer for determining a state's progression towards "modernity", a central concern for the GDR.[25] However, a system that was desperate to highlight its every technological achievement but without the consistency to allow these achievements to recede into unremarkability was vulnerable to parody, as occurred to initially serious terms used as motivating catchphrases like "real socialism" or "actually existing socialism". The overabundance of symbolism that could be attached to much of the GDR's industrial capacity and infrastructural facilities thus sometimes provided a difficult contrast with deficits in actual production or functionality.[26] Nevertheless, the links between the political intentions for GDR infrastructures and their consequent collective interpretation are not always straightforward and can raise interesting discrepancies in reductive attempts to assign labels of success or failure to GDR undertakings.[27]

Penny Harvey and Hannah Knox's work on the deep associations that road infrastructure can imbue in a populace has insightful resonances with the GDR case. They attribute to generic infrastructures an ability to "produce a generalised sense of social good to which the majority of people subscribe", but even in the face of failure these structures could maintain an aura of social promise.[28] More broadly,

> Infrastructures do not simply reference or represent political ideology but actively participate in often unexpected ways, in the processes by which political relations are articulated and enacted. Infrastructures can offer a vital means of tracing the co-

[25] Peters, *The Marvelous Clouds*, 31.
[26] Larkin, 'The Politics and Poetics of Infrastructure', 335.
[27] Larkin, 334.
[28] Harvey and Knox, 'The Enchantments of Infrastructure', 522.

> emergence of political and material histories, and in doing so can provide powerful accounts of often unacknowledged dynamics of state formation.[29]

The creation of Funkhaus Berlin, as relayed in Chapter 1, offers a particularly multi-layered and deeply resonant tale of radio infrastructure and state formation across a significant early period for the GDR that encapsulates much of what became characteristic of the state in following decades. Within that larger setting, the recording facilities discussed in the same chapter unify social, technological and infrastructural perspectives - in a manner close to that envisaged in the early stages of this research - to construct a holistic narrative of the meaning and interpretations available for a key GDR cultural project. The emergence of this narrative is rooted in an infrastructural and materially-focussed approach but requires considerable acknowledgement of human components in the search for its valid interpretation. Infrastructure's acknowledgement that a network is more than the sum of its part allows space for the contemplation of the type of associative transference or amalgamating auras that collections of wood, brick and mortar or other forms of things can accumulate over time when they are parts of people's lives.

0.3 Secondary Literature and Structure

This thesis encompasses a timeframe of more than forty years and a wide scope of cultural technologies in both specialised and consumer forms. In its approach, this study attempts to navigate a research material-led path that required the interweaving of analyses of technological processes, political history, sociology, aesthetics and economics. While total precision or expertise is not claimed in any of these areas, the proposed value of this thesis is derived from their convergence. The GDR and the global technological paradigm transformed immensely during the timespan discussed and this study attempts to account for this through rigorous contextualisation. A range of GDR-specific and other specialist studies have made major contributions towards creating a setting in which to place the original research work of this thesis. This was assisted by the considerable diversification of GDR studies conducted over the past three decades and detailed assessments of its large scale industries, its production of consumer goods and its cultural landscape have been developed. This thesis depended on a

[29] Harvey and Knox, 524.

range of publications to provide a broad contextual understanding of the GDR, while a smaller selection of more specialised works in GDR and wider technological and cultural areas helped develop some of the themes that run through this work. A small number of secondary sources provided important augmentation to the primary-source focus of these case studies.

In the broad contextual area, Mary Fulbrook's work is an important starting point for understanding GDR society, while David Crew, Katherine Pence and Paul Betts similarly offer useful entry points into consumer and material narratives in the GDR.[30] Works by Dolores Augustine, Armin Muller and Beate Volker and Henk Flap that engage with Germanic research traditions and hierarchical GDR technical and research structures helped prompt this thesis to look at institutions and organisations and their administration as sources of insight.[31] Papers and analyses that pre-date the end of the GDR retain value for offering - similar to many of the primary sources cited in this thesis - critical assessments of the state without the presumption of an inevitable endpoint.[32] Some pre-Wende cultural papers have a similar value.[33] Carola Kotyczka and Heinz Kroske offer important observations on the GDR's ill-advised attempts to become self-sufficient across a wide range of industrial processes and technological areas.[34] In a similar vein, Raymond G. Stokes' economic analysis of the progression of GDR chemical, electronics and information technology industries is used regularly in this thesis to align the discussed narratives within larger trends, in particular his observation on the contrasting success of pre- and post-Second World War technologies in the GDR.[35] In the field of electronics, the GDR had some basis for restoring the supply of components and products that

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[30] Mary Fulbrook, ed., *Power and Society in the GDR, 1961 - 1979: The 'Normalisation of Rule'?*, 1st ed. (New York, NY: Berghahn Books, 2009); Katherine Pence and Paul Betts, *Socialist Modern: East German Everyday Culture and Politics*, Social History, Popular Culture, and Politics in Germany (Ann Arbor, Mich: Univ. of Michigan Press, 2008); David Crew, 'Consuming Germany in the Cold War', *Socialist Modern: East German Everyday Culture and Politics*, 2008.

[31] Augustine, *Red Prometheus*; Beate Volker and Henk Flap, 'Getting Ahead in the GDR: Social Capital and Status Attainment under Communism', *Acta Sociologica*, 1999, 17; Armin Muller, 'Competing Networks: The SED and the Old Intelligentsia in the Industry of the GDR', *Historical Social Research/Historische Sozialforschung* 35, no. 3 (2010): 134–162.

[32] Thomas A. Baylis, 'Explaining the GDR's Economic Strategy', *International Organization* 40, no. 2 (1986): 381–420, https://doi.org/10.1017/S0020818300027181; Günter Minnerup, 'East Germany's Frozen Revolution', *New Left Review*, no. 132 (1 March 1982), http://search.proquest.com.ezproxy.is.ed.ac.uk/docview/1301937321/250653B3B57648FDPQ/29?accountid=10673.

[33] Günter Mayer, 'Popular Music in the GDR', *Journal of Popular Culture* 18, no. 3 (1984): 145–158, https://doi.org/10.1111/j.0022-3840.1984.1803_145.x.

[34] Carola Kotyczka and Heinz Kroske, 'Technological Change in the GDR and Its Social Consequences', *Technological Forecasting & Social Change* 41, no. 3 (1992): 211–222, https://doi.org/10.1016/0040-1625(92)90021-K.

[35] Raymond G. Stokes, *Constructing Socialism*.

relied on vacuum tubes, but developing comparable levels of production in the area of transistors - a new key post-war technological paradigm – was a limiting factor to the supply of new industrial and consumer technologies. This insight assists the appraisal of trends described in the final chapters of this work.

Culture and music in the GDR has been widely discussed, often with a focus on classical performance repertoire in the context of denazification.[36] Studies in broader cultural fields have usefully highlighted the Berlin Wall's relative "permeability" to cultural dissemination, extremely relevant in the area of broadcasting.[37] Work has also been done to explore the GDR's unusual and inconsistent treatment of electroacoustic composition.[38] The primary materials used by this thesis offered opportunity for the investigation of technological and infrastructural aspects of this important narrative, particularly during the 1950s, though this has unfortunately not been undertaken on this occasion. Studies on popular music in the GDR were an important prompt for my investigation of Deutsche Schallplatten primary sources. Work by Edward Larkey on GDR pop music and its engagement with the West and discographical work by Birgit Rauhut and Michael Rauhut offered important framing narratives for this undertaking.[39] By approaching music in the GDR from several angles, this thesis attempts articulate the importance of the tandem roles of classical and popular music within GDR audio infrastructures.

Establishing some familiarity with the development of acoustic theory and practice in the twentieth century became critical for contextualising this thesis due to the unique character

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[36] Toby Thacker, *Music after Hitler, 1945-1955* (Aldershot : Ashgate, 2007); Janik, *Recomposing German Music*; Monod, *Settling Scores*; Mark Carroll, *Music and Ideology in Cold War Europe*, Music in the Twentieth Century (Cambridge: Cambridge University Press, 2003).

[37] April A. Eisman, 'East German Art and the Permeability of the Berlin Wall', *German Studies Review* 38, no. 3 (2015): 597–616, https://doi.org/10.1353/gsr.2015.0115; Elaine Kelly and Amy Wlodarski, *Art Outside the Lines : New Perspectives on GDR Art Culture* (Amsterdam ; New York : Rodopi, 2011).

[38] Tatjana Böhme-Mehner, 'The Big Beginning at the End: The Formation of a Fully-Fledged Generation of Composers of Electroacoustic Music in the Last Years of the GDR', *Contemporary Music Review* 30, no. 1 (2011): 119–123, https://doi.org/10.1080/07494467.2011.624320; Tatjana Böhme-Mehner, 'Does the GDR Have Its Own Electroacoustic Sound?', *Contemporary Music Review* 30, no. 1 (February 2011): 5–13.

[39] Edward Larkey, 'GDR Rock Goes West; Finding a Voice in the West German Market (1)', *German Politics and Society* 23, no. 4 (20051222): 45; Edward Larkey, *Rotes Rockradio : populäre Musik und die Kommerzialisierung des DDR-Rundfunks* (Berlin : Lit, 2007); Edward Larkey, *Pungent Sounds : Constructing Identity with Popular Music in Austria / Edward Larkey*, Austrian Culture: Vol. 9 (New York : Peter Lang, [1993], ©1993., 1993); Edward Larkey, 'GDR Rock Goes West; Finding a Voice in the West German Market (1)', *German Politics and Society*, no. 4 (2005): 45; Birgit Rauhut and Michael Rauhut, *Amiga: die Diskographie aller Rock- und Pop-Produktionen 1964 - 1990; Mit über 1500 teilweise farbigen Abbildungen* (Berlin: Schwarzkopf & Schwarzkopf, 1999).

of progressive acoustics in the GDR, but this survey also highlighted important general absences. The corpus of authoritative works on venue acoustics has expanded substantially since the 1950s and most of these large works acknowledge the lengthy historical development of venue acoustics before 1900 and the relatively rapid proliferation of rigorous – though often still flawed - acoustic designs since the Second World War.[40] The steady progress in acoustic science theory and its application has not been accompanied by corresponding developments in broader analyses of modern-era acoustic developments and applications that place modern acoustic and venue designs within ongoing social and political historical progressions. The social and political contexts of post-war performance venues have generally only been studied in isolation and shared post-war design impulses and their emergence in different acoustic forms in venues and recording spaces constructed across the world invite extended analysis. Architectural historians, notably Victoria Newhouse, have been more willing than musical historians or cultural sociologists to engage with the implications of acoustic designs beyond their contributions to reverberation fields.[41] Newhouse's account of the recognition of psycho-acoustic factors evident in acoustic designs such as the Berliner Philharmonie and its descendants, along with interpretations of its auditorium as a "democratised" space, are suggestive of a humanistic approach to analysing acoustics that could complement and augment the discipline's scientific base. The design narrative present within the recording spaces and performance venues of the GDR and relayed in this thesis makes a strong advocation for such an approach. Other historians whose work has contributed to this thesis in acoustic and architectural areas include Hugh Campbell, Fiona Smyth and Carol Anne Costabile-Heming, each providing specific contextual insights that fortified findings from several lines of enquiry.[42]

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[40] Leo L. Beranek, *Concert Halls and Opera Houses: Music, Acoustics, and Architecture*, Second edition.. (New York, N.Y.: Springer, 2004); Michael Barron, *Auditorium Acoustics and Architectural Design*, Second edition. (London ; New York: Taylor & Francis, 2010); Vilhelm Lassen Jordan, *Acoustical Design of Concert Halls and Theatres: A Personal Account* (London: Applied Science Publishers, 1980); Robin Mackenzie, *Auditorium Acoustics* (London: Applied Science Publishers, 1975); Vern Oliver Knudsen, *Acoustical Designing in Architecture* (New York ; London: Wiley, 1950).

[41] Victoria Newhouse, *Site and Sound : The Architecture and Acoustics of New Opera Houses and Concert Halls* (New York: Monacelli, 2012).

[42] Hugh Campbell, '"The Bright Edifice of Community": Politics and Performance in Hans Scharoun's Berlin Philharmonie', *Arq : Architectural Research Quarterly; Cambridge* 11, no. 2 (June 2007): 159–66, http://dx.doi.org.ezproxy.is.ed.ac.uk/10.1017/S1359135507000632; Fiona Smyth, 'Hope Bagenal and Wallace Clement Sabine: A Legacy in Letters', *Acoustics Bulletin* 40, no. 2 (2015): 26–30; Carol Anne Costabile-Heming, 'The Reconstructed City Palace and Humboldt Forum in Berlin: Restoring Architectural Identity or Distorting the Memory of Historic Spaces?', *Journal of Contemporary European Studies* 25, no. 4 (2017): 441–454, https://doi.org/10.1080/14782804.2017.1361816.

The five case studies of this thesis follow a loose overall chronology and work together to offer a coherent historical narrative for several contained aspects of the GDR audio industry. While this thesis is thus intended primarily as a holistic work, its constituent chapters do stand alone as pointed microhistories and may be approached in isolation. The first two chapters of this thesis are comprised of separate investigations of two of the GDR's major audio institutions: Rundfunk DDR and Deutsche Schallplatten. Rundfunk DDR and Deutsche Schallplatten have interwoven histories thanks to their recording activities, but the two organisations were very different in character. Rundfunk DDR exhibits familiar characteristics of a national broadcaster, while Deutsche Schallplatten, even after its nationalisation, was run much more similarly to a private company. These differences were important to how each developed its recording capacities. Radio broadcasting and music records both have extensive pre-war histories in Germany and both chapters concern narratives of restoration and technological development involving two very different forms of cultural material. Establishing these efforts within a wider historical technical narrative was essential to unlocking the themes of this thesis, but rigorous technical histories remain uncommon and thus contextual references in this study are often not specific to the GDR or Germany. Walter Leslie Welch and Leah Brodbeck Stenzel Burt's general history of early music formats was valuable, but also highlights a shortage of analysis on the material narratives of mechanical musical reproduction in every period.[43] Broader works on the GDR's material fabrication industry and foreign commercial relations were of more relevance to the investigations of this thesis by providing more applicable local and contemporary context.[44] Asa Briggs' history of the BBC was of some contextual assistance - despite a lack of focus on technical areas - but the BBC's own annual year books contributed much more to a technical context of broadcasting in Europe before the Second World War.[45] Within this thesis the BBC is primarily used as a point of technical and infrastructural comparison, but its active role in Cold War era broadcasting warrants further investigation.[46] The infrastructure of Germany's pre-war national broadcaster,

[43] Walter Leslie Welch and Leah Brodbeck Stenzel Burt, *From Tinfoil to Stereo: The Acoustic Years of the Recording Industry, 1877-1929*, Revised edition. (Gainesville, Fla.: University Press of Florida, 1994).
[44] Pavel Szobi, 'Between Ideology and Pragmatism: The ČSSR, the GDR and West European Companies in the 1970s and 1980s', *European Review of History: Revue Europeenne d'histoire* 21, no. 2 (2014): 255–269, https://doi.org/10.1080/13507486.2014.888705; Eli Rubin, *Synthetic Socialism: Plastics & Dictatorship in the German Democratic Republic* (Chapel Hill: University of North Carolina Press, 2008).
[45] Asa Briggs, *The History of Broadcasting in the United Kingdom. Vol. 2, The Golden Age of Wireless*. (London: Oxford University Press, 1965).
[46] Nicholas Pronay and Philip M. Taylor, '"An Improper Use of Broadcasting..." The British Government and Clandestine Radio Propaganda Operations against Germany during the Munich Crisis and After', *Journal of Contemporary History* 19, no. 3 (1984): 357–384, https://doi.org/10.1177/002200948401900301; Patrick Major,

the Reichs-Rundfunk-Gesellschaft (RRG), is key to understanding later events in GDR broadcasting; work by Günter Pipke and Friedrich Engels provided insights in this area.[47] Nicholas J. Schlosser and Heather Leigh Gumbert offered broad and detailed analysis of technical and journalistic occurrences in GDR broadcasting that was very useful for constructing several sections of this thesis.[48] Work on broadcasting in West Germany appears to delve into perhaps more diverse areas than that seen with studies of the GDR; works of this type were beneficial for contextualising various gradations in GDR primary sources across different periods.[49]

Within the case studies that follow are tracings of the trajectories of several fairly familiar technologies and the particularities of their introduction into the GDR context. Simplified narratives in the historicisation of various technologies attributable to pre-existing commercially-constructed chronologies can imperil new technological research and criticism by providing easy answers. This remains a hazard in contemporary discourse; excitement and anxieties in the interpretation of the continuing unfolding of digital media's seemingly ubiquitous role in society can lead to superficial analyses. Joseph Sterne has warned that "to refer to digital media as 'new' technologies is to import the value-system of advertisement into scholarship, where 'newness' is itself an index of sociocultural significance and transformative power."[50] Sterne's characterisation is applicable to how some technological progressions were handled in the GDR. Although its system of values had some distinctions to those of Western capitalism, the rhetoric of 'newness' and 'progress' had similarly powerful connotations that were co-opted into state-sanctioned narratives of modernity. Several of the technological narratives presented in this thesis have been attributed interpretations that can drift between inherited and more rigorous and pluralistic assessments. Work elsewhere has sought to

'Listening behind the Curtain: BBC Broadcasting to East Germany and Its Cold War Echo', *Cold War History* 13, no. 2 (2013): 255–275, https://doi.org/10.1080/14682745.2012.746840.

[47] Friedrich Engels, 'Walter Weber's Technical Innovation at the Reichs-Rundfunk-Gesellschaft', in *AES Convention 94* (Berlin: AES, 1993); Günter Pipke, *Rundfunk und Politik, kleine Geschichte des Rundfunks in Deutschland*. ([Hanover], 1961).

[48] Nicholas J. Schlosser, 'Creating an "Atmosphere of Objectivity": Radio in the American Sector, Objectivity and the United States' Propaganda Campaign against the German Democratic Republic, 1945–1961', *German History* 29, no. 4 (December 2011): 610–27; Heather Leigh Gumbert, 'East German Television and the Unmaking of the Socialist Project, 1952–1965' (Ph.D., The University of Texas at Austin, 2007).

[49] Christoph Classen, 'Captive Audience? GDR Radio in the Mirror of Listeners' Mail', *Cold War History* 13, no. 2 (2013): 239–254, https://doi.org/10.1080/14682745.2012.757136; Monika Röther, 'Pop Songs for the Tape Recorder, LPs for the Record Player? The Market Launch of Tape Recorders in West Germany and the Copyright Debate on Young Consumers' Practice of Tape-Recording in the 1950s and 1960s', *Historical Social Research / Historische Sozialforschung*, no. 3 (125) (2008): 301.

[50] Sterne, 'Bourdieu, Technique And Technology', 368.

dismantle the more deterministic trends in various technological assessments and some of this is work is cited below. The case studies presented in this thesis - centred on circumstances often distant from the heart of the dominant cultural and technical formations of this period - often provide confirming material for dismantling the overriding and conveniently seamless sequences routinely attached to vinyl records, stereophonic sound and early digital technologies. As an example, recent sound studies work has sought to dispel characterisations of stereo's development as one of linear progression towards an inevitable endpoint of peak "naturalness" and the East German case provides ample evidence for further disrupting this narrative.[51] Nevertheless, engagements with emic narratives and interpretations perform a crucial role in this thesis.

Much of the primary material on which this thesis is based is situated within the highly politicised rhetoric of progress and modernity that underpinned the competitive technological texture of the Cold War era. It is thus worth highlighting the extent to which the GDR project was politically and psychologically invested in the transformative potential of various technologies - particularly information technologies in its latter stages - in the hopes that these would bridge widening gaps of achievement and production. The GDR's language of technology could undoubtedly aggrandise and distort but there was also deep investment across multiple levels of GDR hierarchy in an ideal of technology as a solution to all ails that was profoundly integral to sustaining its political and societal project. It was therefore one of the more challenging tasks of this research project to walk the line between incorporating contemporary GDR technology descriptions and assessments as part of a critical discourse analysis, without becoming overly susceptible to internalising the assumptions of that rhetoric. While contributing to the clear outlining of several technical narratives is part of the ambition of this thesis, describing something of the more general condition of the GDR and it's people and processes is much more central to its mission. The GDR's position at a nexus between two major competing political and technological powers and the value in the continued enhancement of interpreting its position within those dynamics provide the justification for this risky approach.

[51] Paul Théberge, Kyle Devine, and Tom Everett, *Living Stereo : Histories and Cultures of Multichannel Sound* (New York, NY ; London: Bloomsbury Academic, 2015), 21; Eric Barry, 'Mono in the Stereo Age', in *Living Stereo : Histories and Cultures of Multichannel Sound* (New York, NY ; London: Bloomsbury Academic, 2015), 130.

Chapter 1 draws on a wide range of sources to synthesise a new analysis on the development, design and use of Funkhaus Berlin, in particular its recording wing, Block B. Reflecting Alfredo Thiermann's recent observations on the uniqueness of the recording spaces in Block B, this thesis demonstrates the worthwhile opportunities for exploration latent in such uniqueness.[52] The creation of Funkhaus Berlin was fraught and closely linked with circumstances surrounding its predecessor, Haus des Rundfunks. Tracking the technical progression between these facilities was considerably aided by G. Lubszynski and K. Hoffmann's contemporary technical paper on the facility just after its construction in 1930.[53] The limited architectural commentary in this thesis was assisted by Bernhard Kohlenbach's work on the Funkhaus Berlin architect, Franz Ehrlich, as well as Franz Berger exhaustive run-through of Funkhaus Köln, frequently used as a control in Chapter 1.[54]

The initial impetus for Chapter 2 was provided by Lindsay Hansen's paper, "A Well-Oiled Machine: The Creation and Dissolution of East Germany's VEB Deutsche Schallplatten".[55] Following on from Hansen's linking of technical processes to Deutsche Schallplatten's success, Chapter 2 deals with physical recorded music formats and how the transferral of music records from one material format to another played out under the stewardship of general director Harri Költzsch. While the Bundesarchiv material covers the full sweep of Deutsche Schallplatten's existence, the most prominent narrative that emerged from these resources demanded a focus on the early lifetime of the company: from the mid-1950s to the early-1960s. Efforts to produce an analysis of similar scale for Deutsche Schallplatten's latter two decades have been condensed to provide an important contrast to the volatility of its early period. Chapter 2 also attempts to begin an analysis of how music genre policies at Deutsche Schallplatten were impactful across diverse areas of the company. Some West German studies were helpful in this area, but the primary research materials provide most of the subjects of discussion.[56] Important for positioning the plethora of statistics offered by these archival sources were Rémy Louis' history of Deutsche Grammophon and Horst Lange's

[52] Alfredo Thiermann, 'Radio Activities', *Thresholds*, 1 August 2017, 194–210.
[53] G. Lubszynski and K. Hoffmann, 'The Broadcast Installations in the New "House of Radio"', *Proceedings of the Institute of Radio Engineers* 19, no. 11 (1931): 1955–1970.
[54] Bernhard Kohlenbach, 'Franz Ehrlich - ein Architekt zwischen Bauhaustradition und DDR-Baudoktrin', *ICOMOS – Hefte des Deutschen Nationalkomitees* 20, no. 0 (1996): 44–47; Franz Berger, *Das Funkhaus in Köln und seine Gestaltung* (Stuttgart: Alexander Koch GmbH, 1964).
[55] Lindsay Hansen, 'A Well-Oiled Machine: The Creation and Dissolution of East Germany's VEB Deutsche Schallplatten', *ARSC Journal* 43, no. 1 (1 March 2012): 1.
[56] Benno Nietzel, 'Culture, Entertainment and Listening Habits in the West German Discourse on Radio during the 1950s.(Report)' 32, no. 1 (2014): 15.

discography of German 78s.[57] Classical and popular music were both central to Deutsche Schallplatten's activities and this chapter attempts to give attention to both of these areas.[58] It is unfortunate that the Recording Industry Association of America's powerful online US sales database tool only offers data from 1973 onward; this could have offered potential points of comparison with occurrences in the GDR.[59] A broader picture of record production levels in West Germany has also not been uncovered in the course of this thesis, other than Louis' previously cited work on Deutsche Grammophon. By contrast, Kevin Tennent's paper on record distribution in the UK provided statistics that were helpful for corroborating or contrasting trends with record production in the GDR.[60]

Chapter 3 details the introduction of stereophonic recording techniques and equipment to the GDR during the early 1960, builds on Chapter 1 broadcasting themes and serves as a chronological and thematic bridge to the topics of Chapter 4 and Chapter 5. It does so by covering the transition to stereophonic sound along with the transistorised technologies that accompanied the entry of stereo into the consumer sphere; important contextually to technological efforts in the GDR during the 1970s and 1980s. FM radio and vinyl records were audio technology formats that preceded stereo that required similarly extensive reconfigurations of the GDR's audio infrastructure, but both of these new formats offered considerable qualitative and infrastructural advantages over their predecessors. In the case of FM broadcasting, adoption of the transmission method ensured the integrity of the GDR's broadcast network during a fraught political period. Richard Merritt's article on electronic media in post-war Berlin helps establish this, while Gary Lewis Frost's work on FM and its early history in the US demonstrates why the format's technical features are key to discerning its role in post-war Europe.[61] Andreas Vogel's article on the introduction of FM to the GDR

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[57] Rémy Louis, *Deutsche Grammophon: State of the Art: Celebrating over a Century of Musical Experience* (New York: Rizzoli, 2010); Horst Heinz Lange, *Die deutsche '78er' Discographie der Hot-Dance- und Jazz-Musik : 1903-1958*, 2., erw. Aufl. (Berlin: Colloquium Verlag, 1978).
[58] Irmela Hannover, *Puhdys: Eine Kultband Aus Dem Osten* (Berlin: Elefanten Press, 1994); Ronald Galenza and Heinz Havemeister, eds., *Wir wollen immer artig sein ...: Punk, New Wave, HipHop, Independent-Szene in der DDR 1980 - 1990*, 2nd ed. (Berlin: Schwarzkopf & Schwarzkopf, 1999).
[59] 'U.S. Sales Database', RIAA, accessed 9 December 2018, https://www.riaa.com/u-s-sales-database/.
[60] Kevin D. Tennent, 'A Distribution Revolution: Changes in Music Distribution in the UK 1950–76', *Business History* 55, no. 3 (1 April 2013): 327–47, https://doi.org/10.1080/00076791.2012.712963.
[61] Richard L. Merritt, 'Divided Airwaves: The Electronic Media and Political Community in Postwar Berlin', *International Political Science Review / Revue Internationale de Science Politique*, no. 4 (1986): 369; Gary Lewis Frost, *Early FM Radio: Incremental Technology in Twentieth-Century America* (Baltimore, Md.: Johns Hopkins University Press, 2010).

provides essential information on broadcasting infrastructure in the state during this period.[62] Stereo had far less immediate strategic advantages than an innovation like FM. It provided a supplemental qualitative addition to FM radio and vinyl records, but its advantages were much narrower in their application and largely reserved to improving music recordings. As an infrastructural upgrade, it was thus justified under very different rhetoric and serves better as an indication of the GDR's commitment to cultural infrastructures alongside more general broadcasting purposes. Kristine Nielson's work on elaborate "gifts" from the GDR state to its citizens is instructive in this context.[63]

Stereo's relatively unproblematic introduction is indicative of the GDR's relative robustness during this period. Stereo is also significant within German narratives due to the technology it depended on as its primary recording medium: magnetic recording tape. While the German role in the development of tape recording is usually acknowledged in comprehensive histories, the post-war route of US-augmented tape recording technology back to West Germany and the GDR has had less commentary. The process behind the arrival of an international standard for stereophonic vinyl records is similarly obscure. H. E. Roys' personal account of the events that led to the adoption of a universal industry standard is an excellent example of a technical innovation deeply embedded in widespread experience, but with little accompanying understanding or discussion regarding how it was derived.[64] In the context of this chapter it helps indicate informal political camps in the technical communities of the international record industry. Both magnetic tape and vinyl records are key to unravelling GDR audio infrastructures and the application of stereo to these technologies offers additional insights.

Stereo and its associated technologies have become so ubiquitous, it proved difficult to find accounts that unpack the formation of these in more than a cursory fashion. Alan Dower Blumlein's association with stereo is well-earned - although his is not the full story of the format - and Robert Charles Alexander's biography provides helpful context on the early era

[62] Andreas Vogel, 'Zum Verlauf von Innovationsprozessen in der Rundfunkgeräteindustrie der BRD und der DDR am Beisspiel der Einführung der UKW-Technik', in *DDR Innovationsverhalten & Entscheidungsstrukturen: Vergleichende Studien zur wirtschaftlichen Entwicklung im geteilten Deutschland 1945-1990* (Berlin: Duncker & Humblot, 1996).
[63] Kristine Nielsen, 'Quid pro Quo: Assessing the Value of Berlin's Thälmann Monument', in *Art Outside the Lines* (Amsterdam ; New York: Rodopi, 2011), 65–88.
[64] H. E. Roys, 'Reminiscing—The Stereophonic Record', *Journal of the Acoustical Society of America* 77, no. 4 (1985): 1332–1334.

of rigorous stereo experimentation.[65] Two accounts proved particularly useful for delineating the progress of stereo sound and magnetic tape: John Sunier's *The Story of Stereo* and Mark Mooney Jr.'s article on magnetic tape both comment on stereo sound as near-contemporaries to its systematic introduction.[66] W. Lippert's detailed account of a stereo recording experiment conducted in Berlin in 1947 provides a tantalising glimpse of a stereophonic counter-history, before US-led experimental work provided the definitive international stereophonic paradigm.[67] Even subsequent to stereo's industry standardisation, there were myriad GDR-specific formations around its execution and usage. Recently, Tom Perchard's work on audio in post-war Britain has delineated interesting interactions between technological developments in consumer audio, commercial structures and the gendering of interactions with hifi equipment in specialist consumer advertising.[68] This raises intriguing points for comparison with the GDR's centrally organised manufacturing and distribution structure and socialist but paternalistic consumer electronics press. GDR publications mirrored trends in the West of training customers in the correct usage of stereo playback but were more capable of envisaging women as specialised listeners.[69]

The final two chapters of this thesis both concern research projects in the latter years of the GDR and are reflective of the GDR's audio communities' commitment to independent research and development. Chapter 4 discusses the Delta Stereophony System (DSS), a bespoke sound reinforcement and venue acoustic modifying system designed to handle the complicated technical remit of the large performance venue of the Palast der Republik. This venue was configured during a period when sound technologies more commonly used for popular music concerts were beginning to be increasingly applied to augmenting classical music performance. The DSS installation incorporated boldly technological approaches to venue acoustics that can be positioned within larger narratives of GDR acoustic design, international acoustics and sound reinforcement development, as well as strategies for broadening audience engagement within the GDR. The origins of the DSS concept are of

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[65] Robert Charles Alexander, *The Inventor of Stereo: The Life and Works of Alan Dower Blumlein* (Oxford: Focal Press, 1999).
[66] John Sunier, *The Story Of Stereo* (Gernsback Library, Inc., 1960); Mark Mooney Jr., 'The History of Magnetic Recording', *HI-FI Tape Recording*, February 1958, americanradiohistory.com.
[67] W. Lippert, 'Stereophonische Zweikanalübertragung mit dem Magnetophon', *Funk und Ton*, no. 5 (1947): 227–78.
[68] Tom Perchard, 'Technology, Listening and Historical Method: Placing Audio in the Post-War British Home', *Journal of the Royal Musical Association* 142, no. 2 (2017): 367–399, https://doi.org/10.1080/02690403.2017.1361176.
[69] Théberge, Devine, and Everett, *Living Stereo*, 25.

historical note and are addressed cursorily in the chapter, as is the largely unacknowledged influence DSS had on sound reinforcement in Europe during and after the GDR-period.

Building on some of the acoustics themes introduced in Chapter 1, the analysis of DSS relies heavily on a number of historical case studies to indicate a potential development narrative and to draw out the unique elements of the DSS and Palast der Republik designs. Key amongst these are Harry F. Olson's account of RCA's distributed sound system experiments, Parkin and Morgan's account of the refurbishment of the Royal Festival Hall during the 1960s, Rudolf Vermeulen's Stereo Reverberation experiments and Edgar B. Young and Leo Beranek's accounts of the Lincoln Center design process.[70] Mark Poletti's article on active acoustics was useful for historicising these extremely diverse examples within contemporary developments.[71] The Palast der Republik itself is deserving of far more analytical work than it has received to date, but several writers provided important contextual understanding of that structure and space.[72] Like much of this thesis, DSS and the Palast der Republik became subjects of interest due to relevant holdings of the DRA. However, the analysis offered in Chapter 4 was only possible due to the relatively wide disseminations the RFZ made on DSS during the 1980s, as the organisation attempted to market the system for commercial installations.

Chapter 5 deals with System 2000, a long-term project to develop digitally-enabled sound technologies to replace the technical infrastructure of Rundfunk DDR and performance venues in the GDR. A period of relative technological stability after transistorised equipment supplanted valve-based technologies led into another period of technological upheaval as microelectronics and digital technologies began to be integrated into sound equipment during

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[70] Harry F. Olson, 'Acoustoelectronic Auditorium', *The Journal of the Acoustical Society of America* 31, no. 7 (1 July 1959): 872–79, https://doi.org/10.1121/1.1907811; Edgar B. Young, *Lincoln Center, the Building of an Institution* (New York: New York University Press, 1980); R. Vermeulen, 'Stereo Reverberation', *IRE Transactions on Audio* AU-4, no. 4 (July 1956): 98–105, https://doi.org/10.1109/TAU.1956.1165636; P. H. Parkin and K. Morgan, '"Assisted Resonance" in The Royal Festival Hall, London: 1965–1969', *The Journal of the Acoustical Society of America* 48, no. 5A (1 November 1970): 1025–35, https://doi.org/10.1121/1.1912240.
[71] M. A. Poletti, 'Active Acoustic Systems for the Control of Room Acoustics', *Building Acoustics* 18, no. 3–4 (1 December 2011): 237–58, https://doi.org/10.1260/1351-010X.18.3-4.237.
[72] Khadija Carroll La, 'The Very Mark of Repression.', *Architectural Design* 80, no. 5 (2010): 116–123; William J. V. Neill, 'Memory, Collective Identity and Urban Design: The Future of Berlin's Palast Der Republik', *Journal of Urban Design* 2, no. 2 (1997): 179–192, https://doi.org/10.1080/13574809708724403; Ines Weizman, 'Palast Der Republik (Palace of the Republic): Designed by HEINZ GRAFFUNDER. Berlin, Germany, 1973–2008', *Journal of Architectural Education* 67, no. 1 (2013): 135–137, https://doi.org/10.1080/10464883.2013.767147; William J. V. Neill, 'Place Visions and Representational Landscapes: "Reading" Stormont in Belfast and the Palast Der Republik in Berlin', *Planning Practice & Research* 13, no. 4 (1998): 389–406, https://doi.org/10.1080/02697459815950.

the 1970s. The System 2000 development process largely confirms common criticisms of the GDR's straitened electronics industry, but also indicates how the GDR had credible plans to maintain its sound infrastructures into the next century. Sound desks rarely receive historical attention outside of their associations with particular studios or musical groups, but System 2000, and the GDR audio technology systems that preceded it are directly tied to an intricate national social and political narrative and warrant analysis in this light.

Kevin L. Ryan's book *Recording the Beatles* is largely focussed on technology at Abbey Road EMI, but it is a relatively rare example of an authoritative work attempting to place audio technology developments within a broader non-technical narrative.[73] The book also establishes interesting links between important mixing desk designs undertaken in collaboration between EMI in the UK and West German record companies. The book provides a timeline useful for aligning the important technological developments made at Rundfunk DDR during the 1960s. An understanding of the transistor's role in post-war technologies and the dynamics of its production during the Cold War are important keys to understanding GDR successes and failures during its latter stages, works by Michael Riordan and Eric Schuster contributed to this.[74] Closely related to the transistor is the progression of information technologies. System 2000 brought Rundfunk DDR into direct engagement with the GDR's information technology industry and a broad set of authors have contributed to disassembling this volatile area of the GDR's industrial efforts. These efforts include works by Gary Geipel, James W. Cortada, Simon Donig, Gareth Dale and Dieter Hoffmann and Kristie Macrakis; System 2000 engages with the broad narratives provided by these authors in interesting ways.[75] The progression and digitisation of sound recording technology receives little or no academic attention and contextualising the efforts of the RFZ on constructing System 2000 required an engagement with the specialised US and UK sound industry print media.

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[73] Kevin L. Ryan, *Recording the Beatles: The Studio Equipment and Techniques Used to Create Their Classic Albums* (Houston, Texas: Curvebender Publishing, 2009).

[74] Michael Riordan, 'The Lost History of the Transistor', *Spectrum, IEEE* 41, no. 5 (2004): 44–49; Eric A. Schuster, 'Transistorized State: The Technique of Hegemony in the Early Cold War', *Perspectives on Global Development and Technology* 14, no. 1–2 (2015): 178–189.

[75] Gary Geipel, 'Politics and Technology in the German Democratic Republic, 1977-1990' (ProQuest Dissertations Publishing, 1993), http://search.proquest.com/docview/304029441/?pq-origsite=primo; James W. Cortada, 'Information Technologies in the German Democratic Republic (GDR), 1949-1989', *IEEE Annals of the History of Computing* 34, no. 2 (2012): 34–48; Dieter Hoffmann and Kristie Macrakis, *Naturwissenschaft und Technik in der DDR* (Walter de Gruyter GmbH, 2018); Gareth Dale, 'Globalism, Microelectronics, and the Demise of the GDR', *Debatte. Review of Contemporary German Affairs* 10, no. 1 (2002): 73–91, https://doi.org/10.1080/09651560220150495; Simon Donig, 'Appropriating American Technology in the 1960s: Cold War Politics and the GDR Computer Industry', *Annals of the History of Computing, IEEE* 32, no. 2 (2010): 32–45, https://doi.org/10.1109/MAHC.2010.6.

This thesis adds to academic work conducted by others on the GDR and cultural technologies. It is hoped that the enclosed analyses provide a coherent detailing of the discussions outlined above and spur some reconsiderations across the areas covered. The application to technological narratives and processes of methodologies more rooted in humanist practices extends the possibility of novel approaches for investigating intersecting areas of culture, technology and politics, both in the GDR and in other contexts, and these should be implemented alongside other methodologies.

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Chapter 1:

Funkhaus Berlin: Broadcasting Houses, Politics and Acoustic Design in the GDR, 1945-1956

Radio in the GDR, as elsewhere, was one of the most cost-effective ways of disseminating state-sanctioned ideologies and notions of culture and broadcasting houses were one of the core components to such efforts. Broadcasting houses were monumental representations of the new technological departures of the twentieth century; key technologies of the radio age they were "temples of transmission that celebrated their own technicity" and recognised as critical modern implements in national formation.[1] The GDR's erection of the Berlin Wall remains the most potent symbol of the division of Germany, but the disentangling of Germany's pre-war national broadcasting apparatus, particularly in Berlin, underlines the material impact of the post-war administrative and political division at a much earlier stage. Significant investment into radio broadcasting and music recording facilities was made by Rundfunk DDR, the national radio broadcaster, during an early stage of the GDR's existence to compensate for the loss of critical facilities lost during the solidification of post-war political boundaries. Central to this new infrastructure was the construction in the early 1950s of Rundfunk DDR's Funkhaus Berlin broadcasting house and its dedicated recording wing, Block B, situated on Nalepastraße at the eastern edge of East Berlin. Block B, a bespoke cluster of studios for music and radio drama recording, was the largest music recording facility ever built in the GDR. Block B took large inspiration from Haus des Rundfunks, the 1930s-built Berlin radio centre that became an important component of the broadcasting apparatus of the Third Reich. However, it also exhibits strong contrasts with its predecessor and it made distinctive departures in the area of acoustics for recording. The respective symphony orchestra recording spaces for Haus des Rundfunks (Sendesaal I) and Funkhaus Berlin (Saal 1) will be highlighted in this discussion. Notable features of Funkhaus Berlin, including its location and architectural and acoustic design, all raise questions about how socialist values and political factors steered an important infrastructural and cultural project in the early years of the GDR. The encirclement and expulsion of East German broadcasting from West Berlin provided a fraught backdrop to the Funkhaus Berlin development and contributed to a narrative of persecution by Western forces within the Rundfunk DDR formation mythology. The value of this narrative was recognised

[1] John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago: University of Chicago Press, 2015), 33.

by the GDR administration and it was actively reinforced by the construction of a complementary but artificial interpretation of an accident that occurred during the construction of Block B.

Funkhaus Berlin is particularly noteworthy as the first large-scale cultural infrastructural undertaking in the GDR and for being among the first opportunities to enact socialist approaches to technology and culture in design on a large scale. The GDR was still in the throes of establishing a coherent unified approach to design processes and the general architectural scheme of Block B exhibits identifiable tensions between historical and practical continuities and socialist and modernist ideals. Parallel to these tensions, the designs of the acoustic spaces in Block B display a specific negotiation of continuity with the innovations of Haus des Rundfunks and the enactment of some radical tangents from the established design parameters of European broadcasting houses. These designs were influenced by an entangled combination of innovative approaches, ideological motivations and practical considerations created by political circumstance. This chapter is an attempt to begin the disentangling of these myriad factors, particularly with regard to Funkhaus Berlin's most distinctive recording space: Saal 1.

Part 1: Technological and Political Narratives in GDR Radio Broadcasting

Germany was at the forefront of the radio revolution in Europe in the early twentieth Century. National radio in Germany began with the formation of the Reichs-Rundfunk-Gesellschaft (RRG) (Reich Radio Corporation) in 1925. The Weimar-era principles that informed this new enterprise meant efforts were made to maintain the political independence of the RRG; the radio company was entirely responsible for programming and central government took responsibility for the development of radio infrastructure.[2] The new medium proved popular; in the years from 1923 to 1926 the number of radio licences in Germany rose from just 460 to over 2 million.[3] By 1930, Germany and the UK had the most developed radio audience figures in Europe with nearly three million radio licenses each.[4] This dawning of the radio age led to the construction of buildings specialised to facilitate radio broadcasting. Haus des Rundfunks located on Masurenallee in the west of Berlin was completed in 1931. BBC Broadcasting House, an analogous facility located in London, was opened in 1932. These buildings and the acoustic and technical facilities they encompassed represented a significant maturation of broadcasting technology and helped establish the technological template for national radio in Europe.

The principles behind the layout of Haus des Rundfunks were centred around acoustic and signal-path considerations. The most clearly demonstrable example of this is the placement of the recording studios. The studio spaces are situated at the heart of the building while the street-facing administrative spaces act as a sound buffer to potential environmental noise-pollution. Figures 1.1 and 1.2 give a sense of this. Although the recording spaces and administration offices are internally contiguous, the sections holding the recording spaces are laid on separate foundations to preserve their acoustic isolation. Similar approaches to preserving acoustic isolation were also adopted at BBC Broadcasting House.[5] Further areas of innovation elaborated in contemporary accounts of the new facility in Berlin focussed on the progress made in power distribution, the centralisation of amplifiers and other electrical and electronics-based services.[6]

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[2] Günter Pipke, *Rundfunk und Politik, kleine Geschichte des Rundfunks in Deutschland*. (Hanover, 1961), 14.
[3] Werner Stankoweit, 'Studiotechnik Rundfunk: Zusammenfassung der Unterlagen über die Entwicklung der Technik des Rundfunks bis 1967, Band I' (Rundfunk DDR, 1967), 16, Deutches Rundfunk Archiv.
[4] 'Table of Wireless Licenses for Various Countries', *BBC Year Book*, 1930, 130, americanradiohistory.com.
[5] 'Broadcasting House', *BBC Year Book*, 1931, 126, americanradiohistory.com.
[6] Lubszynski and Hoffmann, 'The Broadcast Installations in the New "House of Radio"'.

Figure 1.1: An image of Haus des Rundfunks, Berlin taken from the Berlin Funkturm during the mid-1930s. The structures housing the recording studios can be seen within the external boundary of the street-facing administrative sections, one of many indicators of an innovative and holistic approach to facilitating sound recording.[7]

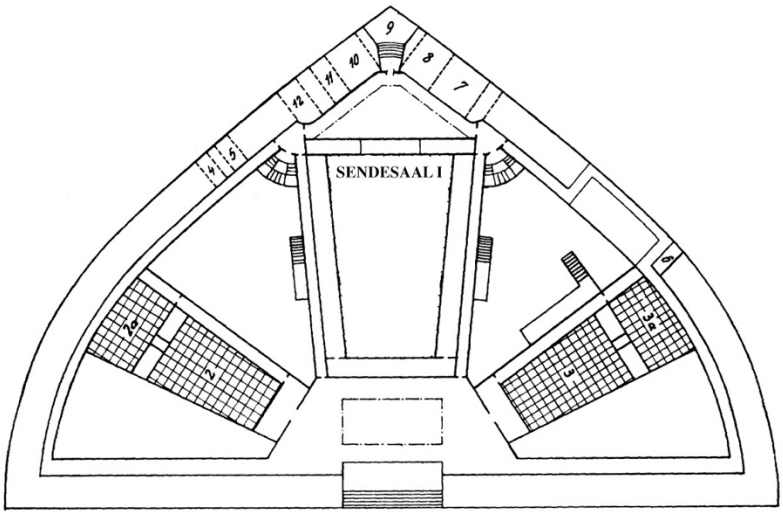

Figure 1.2: A floor plan of Haus des Rundfunks with Sendesaal I labelled in the centre. The distinctive quadrilateral floor plan of Sendesaal I and the other visible recording spaces (2, 2a, 3, 3a) are an important component of the facility's acoustic design enabled by the building's dedication to a single purpose.[8]

Haus des Rundfunks was also innovative in the area of studio acoustics, particularly for music. Studio acoustics until this point were heavily influenced by restrictions relating to contemporary recording media; the reproducible frequency range was narrow and dynamic range was also extremely limited. The wax discs to which performances were initially recorded

[7] E.K., '"Haus Des Rundfunks" - The Headquarters of German Broadcasting', *Wireless World*, 30 July 1937, americanradiohistory.com.
[8] G. Lubszynski and K. Hoffmann, 'The Broadcast Installations in the New "House of Radio"', *Proceedings of the Institute of Radio Engineers* 19, no. 11 (1931): 1956.

were not robust enough to withstand playback and they were primarily used as a template for electroplating metal stampers that could steam press many copies of the recording made from a relatively more hardy combination of shellac and other constituents. The mineral content of gramophone discs contributed a prominent and characteristic hiss; this inherent background noise on the reproducible format created a problematic noise floor with which the performer and recording engineer had to compete. Microphones were not yet a feature of recording practice and the acoustic energy of the musical performance directly contributed the mechanical energy that caused the needle to etch a simulacra of the performance. The sensitivity of this system in comparison with later electrical methods was very limited. These technical limitations strongly influenced the recording methods utilised before the adoption of electrical recording. Early recording practices included the favouring of loud singers and arraying musicians closely around the recording horn. Recording spaces were also specialised to enhance recordings within their limited parameters; a common approach was to counteract room reverberation and deaden the acoustic by hanging heavy drapery or other similar methods. The arrival of the radio age, accompanied by such innovations as microphones and electronic signal amplifiers, allowed a reappraisal of the design of specialised acoustic spaces for recording. The heightened sensitivity of electrical microphones and the ability to increase gain levels using amplifiers meant it became possible to transmit an improved representation of a musical performance, without the same compromises necessary for recording to gramophone records. These improved recording technologies exposed the limitations of these recording spaces as "boomy" or "dead" and unflattering for musical performance.[9] Reverberation, which had hitherto been suppressed in recording, now became one of the primary foci for improving studio acoustics for music recording, in line with its recognised role in live performance. The qualitative significance of reverberation for live musical performance was first described and quantified by the acoustician Wallace Clement Sabine, and directly applied in his influential acoustic design for the Boston Symphony Hall of 1900.[10] Haus des Rundfunks and BBC Broadcasting House were among the first major dedicated recording facilities where the acoustic design of the recording spaces much more closely resembled the performance spaces from which music originated. This was a significant shift from the paradigm that had developed to support early recording formats and was demonstrated most visibly by the studios designed for orchestral performance. Both Haus des Rundfunks and Broadcasting House have large

[9] 'Studio Acoustics', *BBC Year Book*, 1931, 286–87, americanradiohistory.com.
[10] Michael Barron, *Auditorium Acoustics and Architectural Design*, Second edition. (London ; New York: Taylor & Francis, 2010), 6.

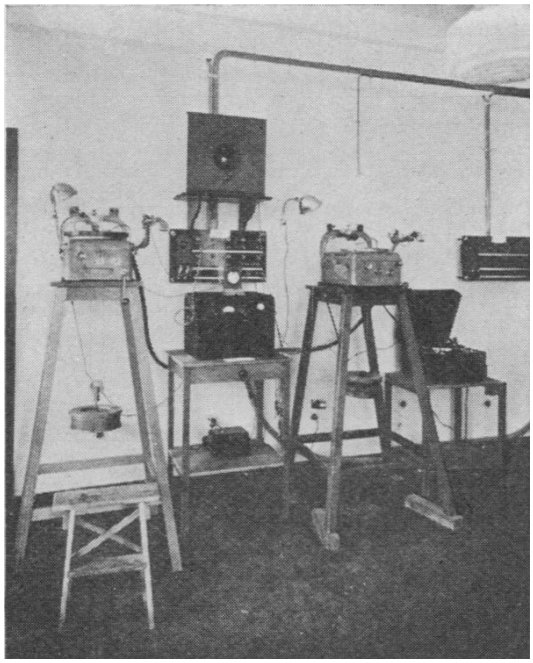

Figure 1.3: A recording facility at Haus des Rundfunks in 1931. Visible on the two tall stands are two disc recorders (probably wax-based) with associated playback and patching equipment in the background. Initially an analytical tool for calibrating the acoustic designs of recording spaces, music recordings made at Haus des Rundfunks became a significant source of broadcast material by the mid-1930s and impacted the usage of Sendesaal I.[11]

recording spaces for symphony orchestra: Sendesaal I in Berlin and the Concert Hall in London. The Concert Hall at Broadcasting House, though smaller than Sendesaal I, has a volume nearly four times greater than that of the biggest recording studio at the BBC's previous headquarters, Savoy Hill.[12] Both spaces emulated the characteristics and conventions of symphony concert halls, notably by incorporating seating for audience. Initially most concert sessions were broadcast live – in part to bypass the technical limitations of recorded formats - and audiences were an integral part of such performances.

Germany was also at the forefront of improved recording formats, with magnetic-wire dictation devices coming into use during the 1920s.[13] The BBC used similar magnetic steel wire and steel tape recording devices from 1926.[14] The audio quality of these devices was limited by the standards of the day, but the flexibility they offered broadcasters was quickly recognised. The RRG's ability to make its own in-house recordings was significant to the

[11] Lubszynski and Hoffmann, 'The Broadcast Installations in the New "House of Radio"', 1968.
[12] 'Ten Years of Technical Progress', *BBC Year Book*, 1933, 49, americanradiohistory.com.
[13] Mark Mooney Jr., 'The History of Magnetic Recording', *HI-FI Tape Recording*, February 1958, 21, americanradiohistory.com.
[14] Asa Briggs, *The History of Broadcasting in the United Kingdom. Vol. 2, The Golden Age of Wireless.* (London: Oxford University Press, 1965), 99.

completion of the acoustic design of Sendesaal I, located at the heart of Haus des Rundfunks. Sendesaal I existed in experimental form between 1931 and 1933, with major alterations made to the stage, seating arrangements, walls and seating.[15] After each alteration, analytical recordings were made until the Sendesaal I design was finalised, Figure 1.3 shows a recording facility at Haus des Rundfunks from this period.[16] In 1935 AEG unveiled the Magnetophon tape recorder at the Berlin Exhibition in 1935.[17] It was the first tape recorder to use magnetic tape with a plastic base. This device had the best audio quality of the era and the reel-to-reel tape format also allowed recordings to be considerably longer than those possible on disc.

The Magnetophon granted RRG a level of flexibility in programming and an ability to re-broadcast both speech and musical programme content that was unmatched technologically by the BBC or US broadcasters at the time. The Magnetophon was further refined during the war and Magnetophons captured by the Allies later became the initial basis for audio tape's commercial development and the introduction of stereo recording in the US in the late 1940s and early 1950s. This is examined in closer detail in Chapter 3. The capabilities of the Magnetophon had immediate implications for how Sendesaal I was used. As the improved recording set-up at Haus des Rundfunks made it feasible and efficient to use Sendesaal I for making orchestral recordings in addition to live broadcasts, the existing acoustic became problematic. The acoustic had been calibrated to account for the presence of an audience. In their absence, the bare wooden seats extended the reverberation time problematically; the short-term solution was to string absorptive panels across the seating rows.[18] Despite these complications, Sendesaal I was a major influence on European broadcasting. The conjunction of public concert hall and national broadcasting centre became a template for a series of publically accessible broadcasting halls built across Europe before, during, and after the Second World War. Many of these implemented specific design features as attempts to reconcile the conflicting acoustic roles of concert hall and recording studio. However, the degree to which the GDR's orchestral recording space at Funkhaus Berlin, Saal 1, later deviated towards prioritising its recording function places it as an outlier in this context. This can be

[15] Gerhard Steinke and Gisela Herzog, *Der Raum ist das Kleid der Musik: Musik-Aufnahmesäle und Hörspielstudios im Funkhaus Berlin-Nalepastrasse sowie weitere Aufführungs- und Hörräume* (Berlin: Verlag Kopie & Druck Adlershof, 2012), 176.
[16] Lubszynski and Hoffmann, 'The Broadcast Installations in the New "House of Radio"', 1968.
[17] Mooney Jr., 'The History of Magnetic Recording', 24.
[18] Stankoweit, 'Studiotechnik Rundfunk: Band I', 8.

attributed, in part, to the unique confluence of circumstances and ideology that accompanied its design.

1.1.1 Intersections of Broadcasting and Politics in Germany

The Nazi Party - or Nationalsozialistische Deutsche Arbeiterpartei (NSDAP) - recognised the political utility of radio broadcasting and their rise to power was characterised by an integrated use of radio to announce and legitimise their regime.[19] Hitler's appointment as chancellor was announced on radio by President Hindenberg in January and the exploitation of RRG's national infrastructure by the NSDAP escalated steadily in the run-up to the decisive March 1933 election.[20] Legitimising political coverage replaced normal programming after the election and Hitler's policy declaration on 22 March was the first broadcast ever made from within the Reichstag chamber.[21] The speech was recorded and later re-broadcast.[22] RRG's music broadcasting capabilities were also a significant element of the political transition; broadcasting services on election day ended with the live relay of the third act of Die Meistersinger from the Staatsoper (Berlin State Opera), attended by the cabinet.[23] Goebbels established a characteristic pattern by instructing the RRG to focus on entertainment programming in the aftermath of the election as a tactic for maintaining the listening public's engagement with the medium.[24] Radio license figures - depicted in Figure 1.4 - show that the radio audience in Germany continued to expand in the lead-up to the Second World War and both factual and entertainment broadcasting remained a constant tool of the NSDAP until the fall of the regime.[25] Audience penetration by radio contributed to the effectiveness of NSDAP propaganda but Germany's sophisticated radio technologies, including the Magnetophon, which assisted the dissemination of political speeches and morale-boosting concert performances, were also key.

[19] Pipke, *Rundfunk und Politik, kleine Geschichte des Rundfunks in Deutschland*., 19; 'News of the Week - Government Broadcasts in Germany', *Wireless World*, 1 June 1932, americanradiohistory.com.
[20] 'German Revolution and Broadcasting', *Broadcasting*, 1 May 1933, 11, americanradiohistory.com.
[21] 'German Revolution and Broadcasting', 11.
[22] 'German Revolution and Broadcasting', 11.
[23] 'German Revolution and Broadcasting'.
[24] 'The Re-Organisation of German Broadcasting', *BBC Year Book*, 1934, 295.
[25] Stankoweit, 'Studiotechnik Rundfunk: Band I', 381.

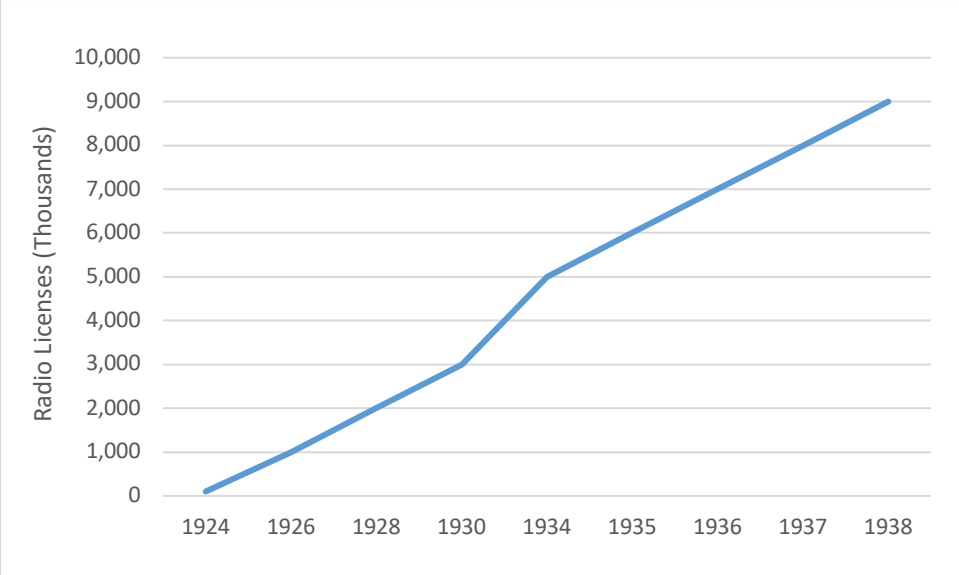

Figure 1.4: The above chart depicts the proliferation of radio licenses in Germany between 1924 and 1938. The rough figures give a sense of a rapidly developing radio listenership in the lead up to the Second World War.[26]

The strategic value of Germany's radio broadcasting infrastructure meant occupiers prioritised its acquisition after the fall of the Third Reich. The Soviet Army captured Haus des Rundfunks after the Battle of Berlin on 2 May 1945 and worked with German technicians to quickly restore Berlin broadcasting.[27] A 1967 collaborative technical history of Rundfunk DDR collated by Werner Stankoweit offers insights into the GDR broadcaster's interpretation of these events. Stankoweit's account characterises the capturing of Haus des Rundfunks as "Die Stunde Null" ("zero hour").[28] This account continues its alignment of radio broadcasting events within broader German history by referring to the first post-war radio transmission in Germany as "Geburtsstunde des DDRs" ("the birth of the GDR").[29] This occurred on the evening of 13 May with the transmission of a speech by Nikolai Berzarin, the Soviet Commander of Berlin, delivered and broadcast from the site of the Tegel transmission tower in north-west Berlin. Due to the destruction of communications infrastructure during the Battle of Berlin, the initial post-war broadcasts from Tegel were heavily reliant on the use of Übertragenswagen (Ü-wagen) (mobile broadcasting trucks), which operated in lieu of Haus des Rundfunks and other broadcasting centres. Self-contained, flexible and often the only surviving un-damaged components of radio infrastructure across much of Germany, the mobility of these surviving Ü-wagen was essential in re-establishing the German radio network. A field-telephone line run

[26] Stankoweit, 381.
[27] Stankoweit, 49.
[28] Stankoweit, 49.
[29] Stankoweit, 49.

between the Tegel tower and Haus des Rundfunks enabled the live transmission of the first post-war broadcast concert from Sendesaal I on 18 May, under the conductor Leopold Ludwig.[30] Haus des Rundfunks was restored to functionality, but this was not without interruption as the line to Tegel was prone to failure. The ability to pre-record broadcasts to tape was thus crucial to the maintenance of the broadcasting schedule, with recordings delivered by hand to the Tegel transmitter until the connection was stabilised.[31]

By the time US troops arrived in Berlin in June, the Soviets had established a new radio entity, Berliner Rundfunk, which was already broadcasting nineteen hours a day from Haus des Rundfunks.[32] For almost a year Berliner Rundfunk was the only radio broadcaster of scale in Berlin; regional broadcasting in East Germany did not recommence for several months.[33] This allowed Soviet-sponsored narratives to be broadcast unchallenged during a period that included the Nuremberg trials and the merging of the Social Democratic Party and the Communist Party, an important milestone on the road to formation of the GDR as a single-party state.[34] The Soviets stonewalled the Western Allies from any meaningful participation in the running of the broadcaster, leading the US to found Rundfunk im amerikanischen Sektor (Radio in the American Sector) (RIAS) as a counterweight in 1946.[35] Despite possessing a less-developed radio infrastructure than Berliner Rundfunk, RIAS was able to quickly develop an impressive journalistic reputation among both West and East German listeners. This was established by active reportage during major periods of unrest, including the Berlin Blockade and the 1953 Uprising. This reputation, gained during the late-1940s and early-1950s, was maintained among GDR listeners throughout its existence at the expense of trust in Rundfunk DDR's journalistic integrity; RIAS and other West German broadcasters remained important alternative sources of news and media in the face of the steady erection of administrative, physical and electronic borders.

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[30] Werner Stankoweit, 'Studiotechnik Rundfunk: Zusammenfassung der Unterlagen über die Entwicklung der Technik des Rundfunks bis 1967, Band II' (Rundfunk DDR, 1967), 62, Deutches Rundfunk Archiv.
[31] Stankoweit, 62.
[32] Nicholas J. Schlosser, 'The Berlin Radio War: Broadcasting in Cold War Berlin and the Shaping of Political Culture in Divided Germany, 1945 - 1961' (University of Maryland, 2008), 36.
[33] Bernhard Hein, *Die Geschichte der Rundfunkindustrie der DDR*, vol. 1 (Dessau: Funk Verlag Bernhard Hein, 2002), 8.
[34] Schlosser, 'The Berlin Radio War: Broadcasting in Cold War Berlin and the Shaping of Political Culture in Divided Germany, 1945 - 1961', 122.
[35] Schlosser, 61.

Broadcasting conflicts between East and West during the Cold War period were often conducted along electronic fronts, but their initiation in Germany was rooted in material infrastructure. As Berliner Rundfunk enacted a partisan programme, the lines that defined the four occupation zones of Berlin began to solidify and to sever connections, tangible and ephemeral. The communication lines that interconnected the restored broadcasting infrastructure of Berlin were fragile and Berliner Rundfunk's reintegrated broadcasting apparatus was sprawled across Berlin. Haus des Rundfunks was in the British sector and the Tegel transmitter was in the French sector. The telegraph exchange at Winterfeldstraße was in the American sector and would eventually become the permanent home of RIAS. As the relationship between the allies deteriorated, the possession and administration of these infrastructural resources by the Soviet military administration and, subsequently, the GDR, became increasingly tenuous. The escalating enforcement by the Western allies of the administrative borders of the occupied zones steadily targeted transgressive components of the East German broadcast infrastructure, forcefully enacting the borders between the opposing spheres of influence and foreshadowing the later erection of the physically impassable – though electronically bypassable - Berlin Wall.

In 1946 and 1947 intermittent disruptions to the communications line between Haus des Rundfunks and Tegel were attributed by Berliner Rundfunk to US sabotage action.[36] Workers at the broadcaster resorted to extracting personal promises from US army personnel that repair works would not be interfered with, but a steady policy of disruption was suspected.[37] A seminal event was the demolition of the Tegel transmitter by the French Army on 16 December 1948.[38] Safety concerns over the landing paths of aircraft at Tegel airport were used by the French authorities to justify this, but the demolition was condemned as politically motivated by the press in the Soviet occupied zone.[39] The loss of the tower required the rerouting of all Haus des Rundfunks transmissions through the radio tower at Potsdam until a new transmitter was erected at Königs Wusterhausen.[40] This left Haus des Rundfunks as the only remaining major piece of broadcasting infrastructure in West Berlin that was still in the

[36] 'Unser Rundfunk hat Geburtstag', *Berliner Zeitung*, 13 May 1955, 111 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19550513-0-2-23-0, ZEFYS.
[37] Stankoweit, 'Studiotechnik Rundfunk: Band II', 66.
[38] 'Berlin empört über Gewaltakt der Sprengung der Tegeler Funktürme', *Neues Deutschland*, 17 December 1948, 294 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19481217-0-1-10-0, ZEFYS.
[39] 'Berlin empört über Gewaltakt der Sprengung der Tegeler Funktürme'.
[40] 'Unser Rundfunk hat Geburtstag'.

hands of the Soviet military administration. In May and October 1949, the division of Germany into two states was confirmed with the founding of the Federal Republic of Germany and the German Democratic Republic. In the spring of 1950 power to Haus des Rundfunks was cut for eighteen days.[41] This was again interpreted as part of a Western policy of encroachment related to the newly formalised territorial situation. Independent power generators, a much-lauded feature of the original installation in the 1930s, allowed work to continue there without much disruption and the new East German state initially retained a firm hold on Haus des Rundfunks.[42]

In 1952 the Soviet administration was preparing to cede full control of the East German broadcasting network to the GDR. This involved the formation of the Staatliches Komitee für Rundfunk (State Broadcasting Committee) along the lines of a Soviet model of centralised radio management and restructured East German radio broadcasting under the name Rundfunk DDR.[43] This period was also marked by a major escalation in attempts to remove the GDR presence from Haus des Rundfunks. On the morning of 3 June 1952, British forces established a boundary around the facility.[44] The day's broadcasting began as normal but GDR radio workers were informed by British soldiers that they would be allowed to leave but not re-enter. Rundfunk DDR responded to the blockade by diverting most of its radio workers to its auxiliary radio centre, Funkhaus Grünau. This was a converted former row house on the outskirts of Berlin that was then in use as an overflow production facility. It now became an important tactical fall-back position for Rundfunk DDR in its efforts to maintain scheduled programming. Haus des Rundfunks continued to broadcast, with assistance from Funkhaus Grünau, but a full programme was not possible.[45] Haus des Rundfunks' telephone lines were still connected and at the end of the first day, a decision was made to have the radio workers remain and occupy the building.[46] The original group of occupiers worked through until 11 June, when the blockade was lifted and the staff rotated out.[47] The blockade was raised again several days later but once Funkhaus Grünau was capable of maintaining a full programme, plans were made to permanently vacate the building.

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[41] Stankoweit, 'Studiotechnik Rundfunk: Band I', 68.
[42] Stankoweit, 68.
[43] Pipke, *Rundfunk und Politik, kleine Geschichte des Rundfunks in Deutschland*., 27.
[44] Stankoweit, 'Studiotechnik Rundfunk: Band I', 77.
[45] Stankoweit, 77.
[46] Stankoweit, 77.
[47] Stankoweit, 77.

The blockading and ultimate loss of Haus des Rundfunks was characterised as a violent trauma and injustice to Rundfunk DDR, its employees and the wider GDR public. Rundfunk DDR, unlike its West German counterparts, traced its origins to the immediate aftermath of the defeat of the Nazis. It regarded this and the efforts of its technicians to restart broadcasting in Berlin as a justification for its inheritance of the centrepiece of German national radio infrastructure. General Berzarin's broadcast speech in 1945, the "Geburtstunde des DDRs", was not just a historical marker, it was a deeply formative moment directly experienced by many of Rundfunk DDR's staff. Stankoweit's history, which focusses primarily on technical narratives, nonetheless relates recollections of General Berzarin supplying groceries to the radio engineers that worked on that first broadcast and the recommencement of broadcasting was idealised as a collaborative effort between Soviet engineers and ideologically motivated, anti-fascist German radio engineers.[48] The Haus des Rundfunks blockade was also mythologised and Stankoweit's account includes anecdotal details that humanise the narrative of events it describes. The senior staff member amongst the occupiers, Karl-Eduard Schnitzler, was remembered for greeting British Army soldiers with a new tie each morning for the duration of the first blockade, despite the shortage of fresh clothing available to the occupiers.[49] The actions and dignity of the Rundfunk DDR staff members who occupied Haus des Rundfunks through the blockade were seen as characteristic of the spirit of the broadcaster's employees, who continued to absorb the loss of essential broadcasting assets due to hostile Western advances. This narrative of historical continuity through broadcasting continuity and the sacrifice and dignity of GDR radio workers in the face of adversity was contrasted against characterisations of the post-war West German broadcasters, in particular RIAS. RIAS was painted as a foreign broadcaster in GDR technical media; it was US-formed and stocked with US equipment, so not only did it lack a historical German lineage, it was not even technologically German.[50] The Haus des Rundfunks blockade spanned five weeks and was ended by negotiation between the West Berlin Senate and the Soviet military administration.[51] Haus des Rundfunks remained nominally in Soviet hands until it was handed over to the West Berlin authorities during a period of relative détente in June 1956.[52] It was renovated and

[48] Stankoweit, 62.
[49] Stankoweit, 78.
[50] Johannes Gradecki, 'Wissenswertes aus der Geschichte des Rundfunks', *Radio und Fernsehen*, May 1958, Deutches Rundfunk Archiv.
[51] Stankoweit, 'Studiotechnik Rundfunk: Band II', 81.
[52] 'Ehemaliges Funkhaus übergeben', *Neues Deutschland*, 7 July 1956, 161 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19560707-0-2-24-0, ZEFYS; 'Es ist möglich', *Berliner Zeitung*, 7 July 1956, 156 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/view1/?purl=SNP26120215-19560707-0-2-164-0, ZEFYS.

became the headquarters of Sender Freies Berlin in 1957. For Rundfunk DDR, the loss of Haus des Rundfunks remained influential within its institutional psyche, internalised within a formation narrative used to motivate the broadcasters counter-capitalist efforts. Beyond the psychology of the institution and its workers, the Haus des Rundfunks saga was also central to the formation and design of its successor at the core of GDR radio broadcasting infrastructure, Funkhaus Berlin.

1.1.2 Locating and Forming Funkhaus Berlin

The loss of Haus des Rundfunk to political manoeuvrings was an enduring source of grievance for Rundfunk DDR, but short- and long-term preparations suggest that it was regarded as an inevitability. In the weeks and months preceding the blockade, valuable instruments, tape archives and equipment were removed in anticipation.[53] Funkhaus Grünau played an important stop-gap role during the blockade - the facility ensured broadcasting did not cease and it acted as an intermediate headquarters and production centre - but it was never intended to serve as a long-term facility. The use of Funkhaus Grünau aligned well with the make-do attitude that pervaded many aspects of post-war recuperation in the GDR, but it had a severely limited production capacity, sub-par acoustics, old equipment and was really only well-suited to preparing speech work.[54] A long-term strategic solution for broadcasting in the GDR was actually already well-advanced by the time of the Haus des Rundfunks blockade. The decision to found a new Funkhaus had been taken in 1951 and renovations began on a vacant factory building adjoining a brownfield site in Oberschöneweide by June of that year.[55]Although the new Funkhaus Berlin was not in a state of preparation that could allow it to take over seamlessly from Haus des Rundfunks when the blockade occurred, some radio production had begun there in the month prior to the blockade.[56] The blockade led to the acceleration of efforts to complete Funkhaus Berlin and the new facility contributed pre-recorded material that was broadcast from Funkhaus Grünau during the blockade.[57] By

[53] Jan Eik, *Besondere Vorkommnisse : politische Affären und Attentate*, 2. Aufl. (Berlin: Eulenspiegel-Das Neue Berlin, 1995), 26.
[54] Stankoweit, 'Studiotechnik Rundfunk: Band I', 68.
[55] Eik, *Besondere Vorkommnisse*, 27.
[56] Stankoweit, 'Studiotechnik Rundfunk: Band I', 81.
[57] Stankoweit, 81.

September 1952, Funkhaus Berlin began assuming the role of primary radio broadcasting site in the GDR.

The encirclement of Haus des Rundfunks had a deleterious impact on the GDR broadcasting schedule, but the pre-initiation of the Funkhaus Berlin project allowed Rundfunk DDR to complete a major transfer of its broadcasting resources within about three months of the start of the blockade. A factor in the relative success of this transfer may have been the secrecy that initially surrounded the Funkhaus Berlin project.[58] Preparations were underway for almost a year before knowledge of the project became widespread and the East German public at large only became aware of the new Funkhaus around the time it began contributing broadcasts during the blockade.[59] A contributor to the success of this clandestine aspect of Funkhaus Berlin was the new facility's relative isolation. Located in an industrial area on the fringes of East Berlin associated with the Rummelsburg and Klingenberg power stations, this contrasts with the comparatively urbanised location of Haus des Rundfunks and an established pattern of locating radio broadcasting houses close to city centres. This connection between broadcasting centres and urban city locations was still being renewed by contemporary developments like Funkhaus Köln in West Germany, completed in 1952, which was located in the heart of the old city adjacent to the city's cathedral. Funkhaus Köln serves as a useful control in comparing the divergent approaches of Funkhaus Berlin from its predecessor and contemporaries and will be referred to throughout this analysis. Rundfunk DDR's relocation to Funkhaus Berlin altered its relationship to the city in a way that mirrored its reactive approach to journalism and which also had implications for the design of its acoustic spaces.

Funkhaus Berlin's comparative distance from East Berlin can be mapped onto journalistic trends established during this period, inferable from occurrences in Berlin during the 1953 Uprising. RIAS had already established itself as an energised and directly engaged broadcaster during the Berlin Blockade and it confirmed this reputation among listeners in the GDR during the 17 June uprising. RIAS's reportage was frequently updated throughout the day but was met by relative silence from Rundfunk DDR, whose journalistic models were still undergoing significant and disruptive transformation.[60] During the rising, the GDR premier,

[58] Eik, *Besondere Vorkommnisse*, 27.
[59] Stankoweit, 'Studiotechnik Rundfunk: Band I', 81.
[60] Schlosser, 'The Berlin Radio War: Broadcasting in Cold War Berlin and the Shaping of Political Culture in Divided Germany, 1945 - 1961', 126.

Walter Ulbricht, ordered the maintenance of normal programming and the first Rundfunk DDR news report was in the evening, meaning Soviet and GDR officials were themselves reliant on RIAS for up-to-date information during the day.[61] While Rundfunk DDR reporters, unlike RIAS, were not engaged in direct, on-the-scene broadcasting, Funkhaus Berlin itself had one notable direct engagement with events. As an important communications hub a radio centre was a likely site for disruption, but its new and distant location seemed to protect it from any focussed confrontation. Stankoweit's history again offers an entry point to Rundfunk DDR's interpretation of its engagement with major historical events, as it includes three subtly differentiated accounts of the disturbance that did occur on 17 June. The first describes how radio workers faced difficulties in getting to work that day but collaborated to minimise any disruption; a group of agitators arrived and urged radio workers to leave their posts but were turned away.[62] The second account is more visceral and describes how Funkhaus Berlin was attacked by rebels who caused some damage but did not manage to disrupt broadcasting.[63] This account directly accuses the RIAS of orchestrating the upheaval in line with the official GDR interpretation and aligns with earlier accounts that relate of Funkhaus Berlin being "stormed".[64] The final account, an entry in a historical timeline, simply states, "Provokation in Berlin. Kollektiv beweist seinen Zusammenhalt." ("Provocation in Berlin. Team demonstrates its togetherness.")[65] What these accounts help to indicate is an alignment between Funkhaus Berlin itself and the defensive and reactive approach of Rundfunk DDR's news reporting.[66] The broadcaster, which regarded Berliner Rundfunk as its progenitor, had enjoyed uncontested control of the airwaves over Berlin only a few years previous. In response to the drawn-out loss of its inherited infrastructure, to a large extent it had fallen back into a protective stance. Its comparatively passive approach to covering the greatest period of unrest in the GDR before the fall of the Berlin Wall contributed to the bolstering of West German broadcasting's role in East German. Its new sequestered broadcasting centre was a further symptom of this stance and these altered circumstances indirectly contributed to the shaping of the acoustic design of the second phase of Funkhaus Berlin.

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[61] Schlosser, 231.
[62] Stankoweit, 'Studiotechnik Rundfunk: Band I', 87.
[63] Stankoweit, 137.
[64] 'Besuch in unseren modernen Hörspielstudios', *Radio und Fernsehen*, May 1958, 363/33/5/1/4, Deutches Rundfunk Archiv.
[65] Stankoweit, 'Studiotechnik Rundfunk: Band II', 400.
[66] Heather Leigh Gumbert, 'East German Television and the Unmaking of the Socialist Project, 1952–1965' (Ph.D., The University of Texas at Austin, 2007), 100.

Verbrecher an unserem Volk werden unschädlich gemacht

Wie aus der Erklärung des Ministerrats der Deutschen Demokratischen Republik über die verbrecherischen Anschläge der imperialistischen Kriegstreiber und ihrer Spionageagenturen hervorging, ist es den Organen der Staatssicherheit gelungen, auch den amerikanischen Agenten Arno Bade hinter Schloß und Riegel zu bringen.

Bade ist eines der gefährlichen Werkzeuge, deren sich die amerikanischen Imperialisten zu ihren Kriegsvorbereitungen bedienen. Dieser Agent wurde nach Beendigung seines Bauingenieurstudiums an der westberliner Technischen Hochschule vom amerikanischen Geheimdienst in die Bauindustrie der DDR geschickt, um durch hinterhältige Verbrechen unsere Friedenswirtschaft zu desorganisieren.

Wie allen erinnerlich, wurde am 16. Februar d. J. in einem der neuen Gebäude auf dem Gelände des Staatlichen Rundfunkkomitees in Berlin-Oberschöneweide ein Brand angelegt, der einen Sachschaden von etwa zwei Millionen DM verursachte. Bei den Löscharbeiten haben damals 14 Personen schwere Verletzungen erlitten.

Untersuchungen haben ergeben, daß der Agent Bade mit Hilfe von Brandsätzen des amerikanischen Geheimdienstes, die er in das Kanalsystem der Klimaanlage einbaute, die neu errichteten Sendesäle in Brand gesteckt hat.

Unser rechtes Bild zeigt den Agenten Bade am Tatort bei der Rekonstruktion der Brandstiftung. Er ist dabei, den Brandsatz in die Druckkammer der Klimaanlage im Erdgeschoß des Neubaues des Staatlichen Rundfunkkomitees einzulegen.

Das Bild links stellt eine aus New York gelieferte Büchse mit Holzspiritus dar, die als Hilfsmittel für Brandstiftungen bestimmt war.

Die Sicherheitsorgane der DDR haben den Verbrecher Bade wie so viele andere mit Hilfe der wachsamen Werktätigen in unserer Republik dingfest gemacht.

Die Verhaftung von 521 Agenten in den letzten Tagen ist eine deutliche Warnung an alle Verbrecher, Agenten und Diversanten. Sie werden unschädlich gemacht, wenn sie unseren friedlichen Aufbau stören wollen. –ge–

Figure 1.5: Front page article from *Neues Deutschland*, April 1955. The article – and others like it – folded Funkhaus Berlin into the broad anti-West narratives of the era by depicting Arno Bade in Block B re-enacting his supposed act of sabotage.[67]

One of the positive attributes of the Oberschöneweide site was the presence of a pre-existing building suitable for conversion and which minimised requirement for new materials. This building, a former furniture and war-time munitions factory, was reconfigured for radio production and served as Rundfunk DDR's new administrative headquarters.[68] However, from the beginning the ambitions for Funkhaus Berlin extended beyond this single repurposed factory block, known as Block A.[69] These ambitions were realised with the construction of Block B, a dedicated music and drama recording facility, begun in 1953 and fully completed in 1956. Block B blended proven acoustic design features with bold new elements and incorporated four music recording spaces of varying size and intention alongside two Hörspiel (radio drama) recording complexes. However, even before Block B was completed, it was given a prominent role in the continuing narrative of Western attacks on East German broadcasting. This was triggered by a fire that broke out on the evening of 16 February, 1955, destroying the interior of the two largest recording spaces.[70] At the time of the fire, Block B was nearing completion: the fundamental structure was complete, the studios were partly clad and workers were installing the climate control plant and electrical systems. The fire and the extent of the damage was reported in the national press on 18 February.[71] By 19 February the

[67] 'Verbrecher an unserem Volk werden unschädlich gemacht', *Neues Deutschland*, 14 April 1955, 86 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19550414-0-1-11-0, ZEFYS.
[68] Eik, *Besondere Vorkommnisse*, 27.
[69] Eik, 27.
[70] 'Beim Rundfunk brannte es', *Neues Deutschland*, 18 February 1955, 41 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19550218-0-6-88-0, ZEFYS.
[71] 'Beim Rundfunk brannte es'.

GDR media started to label the fire as an act of sabotage, referring to reports from police.[72] A report on the fire carried in the *New York Herald Tribune* on 17 February, which cited the West Berlin-based Committee of Free Jurists, was taken as corroboration by the GDR press of the involvement of foreign espionage services.[73] On 14 April, a worker involved with the Block B construction, Arno Bade, was arrested and accused of arson, to which he confessed.[74] Bade was one of 521 "American agents" rounded up in the immediate aftermath of the fire. As reproduced in Figure 1.5, Bade featured on the front page of the *Neues Deutschland* newspaper re-enacting his act of arson in the charred remains of Block B alongside a picture of the accelerant he was reportedly supplied from New York.[75] The institutional reaction prompted by the fire highlights the pitch of tensions running through GDR polity during this period of Cold War paranoia, as well as specific anxieties surrounding its broadcast architecture.

The fire at Funkhaus Berlin was directly used to galvanise a response from Rundfunk DDR construction workers and to inspire solidarity actions amongst the general GDR public. In the weeks following the fire, employees of various radio-related companies volunteered 4000 hours of labour.[76] GDR media emphasised the collective nature of the assault. *Neues Deutschland* quoted a worker saying, "der Brand im Rundfunkhaus… hätte ebensogut bei uns gelegt werden können" ("the fire in the Rundfunkhaus… could just as easily have happened to us").[77] Bade's name became a frequent touchstone for GDR media during discussions of Western espionage actions and was still used in this way as late as 1979.[78] Although an arson attack remained the official GDR narrative for the fire, the writer Jan Eik found this to be a construct in his investigation of several GDR-era scandals. Eik found that the original fire officer report attributed the cause of the fire to faulty or badly-placed temporary electrical

[72] 'Brandstiftung im Rundfunkhaus', *Berliner Zeitung*, 19 February 1955, 42 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19550219-0-2-25-0, ZEFYS.
[73] 'Brandstifter stellten sich selber bloß', *Berliner Zeitung*, 16 April 1955, 88 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19550416-0-2-19-0, ZEFYS.
[74] 'Verbrecher an unserem Volk werden unschädlich gemacht'.
[75] 'Verbrecher an unserem Volk werden unschädlich gemacht'.
[76] 'Eine gute Antwort', *Berliner Zeitung*, 26 February 1955, 48 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19550226-0-6-208-0, ZEFYS.
[77] 'Kabelwerker rüsten zum 1. Mai', *Neues Deutschland*, 14 April 1955, 86 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19550414-0-8-88-0, ZEFYS. "Der Brand im Rundfunkhaus und bei TRO hätte ebensogut bei uns gelegt werden können"
[78] Siegfried Prokop, '521 Agenten Auf Einen Schlag', *Berliner Zeitung*, 4 May 1979, 81 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19790405-0-9-188-0, ZEFYS.

lighting.[79] There were previously reported instances of bad work-practice involving temporary lighting that resulted in melted or smouldering building elements.[80] The GDR's readiness to machinate an elaborate propaganda construct allowed a work-place accident to be used to prolong a narrative of injustices perpetrated against Rundfunk DDR and its predecessor, which began with the destruction of the Tegel transmitter in 1948 and culminated with the ejection from Haus des Rundfunks in 1952. Together, the 1953 Uprising and the manipulation of the Block B fire allowed this narrative to follow Rundfunk DDR to its new location.

[79] Eik, *Besondere Vorkommnisse*, 49.
[80] Eik, 49.

Part 2:

The Expression of Technological and Political Narratives in the design of Block B

Block B was completed in January 1956, almost exactly a year after the fire, and entered operation in February 1956.[81] The restoration of the facility was characterised as a direct retort by GDR workers to the actions of Arno Bade and the generalised threat of Western saboteurs and presented as another example of adversity overcome by Rundfunk DDR and the GDR more widely.[82] Block B, much more than Block A, offered an opportunity for considering how architectural and acoustical design for a recording complex could advance and respond to their placement within new technological, political and geographical contexts. This section looks at general architectural features of Block B and how they were formed by its acoustic functions, some of the specific acoustic design features of the studios themselves, and attempts to contextualise these within the eventful narrative that preceded its construction. While Block B was recognised over several decades as a successful and practical design for a demanding purpose, it is possible to identify tensions between elements of the building and the ideological underpinnings of design in the GDR that were being solidified contemporaneously with the construction of the recording complex. Other features of Block B - and the acoustic design of Saal 1 in particular – are indicative of a radically progressive approach to broadcasting house conventions that align with how cultural ideology developed in the GDR. The team responsible for designing Block B was diverse and this analysis will focus on a relatively small number of informative design components attributed to a variety of contributors; these range from fundamental structural features to decorative details.

The noted architect and designer, Franz Ehrlich, oversaw the Block A renovation and was also the lead architect for Block B. A product of the Bauhaus school, he was a socialist from his youth and had worked with Hans Pölzig, the architect of Haus des Rundfunks.[83] He was sent to a concentration camp before the war began and later served in a penal battalion in the Balkans.[84] Upon his return to Germany, Ehrlich was closely involved with attempts during the early 1950s to develop a design aesthetic that could serve the ideological and practical

[81] 'Von Agenten zerstört — vom Volk wieder aufgebaut', *Neues Deutschland*, 10 February 1956, 35 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19560210-0-1-10-0, ZEFYS.
[82] 'Von Agenten zerstört — vom Volk wieder aufgebaut'.
[83] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 237.
[84] Bernhard Kohlenbach, 'Franz Ehrlich - ein Architekt zwischen Bauhaustradition und DDR-Baudoktrin', *ICOMOS – Hefte des Deutschen Nationalkomitees* 20, no. 0 (1996): 45.

requirements of the GDR; active as an architect during the 1950s, he also designed mass-produced consumer goods like plastic chairs.[85] Ehrlich's first involvement with Funkhaus Berlin - the renovation and extension of Block A - was undertaken under severe time constraints as Rundfunk DDR attempted to pre-empt the loss of Haus des Rundfunks. The preliminary design work was done by Ehrlich's five-person team in just eight days and parts of the building were occupied by radio workers after just six months of building work.[86] Block A was never intended to serve as Rundfunk DDR's primary recording facility; the idea of a dedicated recording wing for music and drama was part of the Funkhaus Berlin concept from the beginning and construction commenced almost immediately after the completion of Block A.[87] Ehrlich had developed some preliminary ideas for a new broadcasting house between 1948 and 1949, when a new facility was planned for Dresden but eventually cancelled.[88] Ehrlich was dedicated to practical and economical design but resisted an aesthetic that was merely functional, which exposed him to controversy. Other than Ehrlich's own design aesthetic, important influences on the final design of Block B include contributions made by Rundfunk DDR on specialist features, material shortages and restrictions imposed by the site. Identifying Ehrlich's particular contributions in the context of a largely collaborative effort is challenging, but interpretation and the identification of incongruencies is possible by drawing on his own writing, interviews, architectural plans of Block B and accounts of how usage of the recording complex developed over forty years.

The formation of a layout for Block B that integrated its acoustic functions in a practical and economical form was a collaboration between Ehrlich and Gerhard Probst, the head technician of Rundfunk DDR.[89] As Block A already incorporated the administrative and general broadcasting facilities for Rundfunk DDR, Block B did not require the integration of these functions - as seen in the Haus des Rundfunks design – and Block B is thus a rare example of a large-scale building built explicitly for the single purpose of recording. Many of the successful acoustic features utilised at Haus des Rundfunks and emulated across Europe were also carried forward into Block B: separate foundations isolated each studio acoustically from

[85] Eli Rubin, *Synthetic Socialism: Plastics & Dictatorship in the German Democratic Republic* (Chapel Hill: University of North Carolina Press, 2008), 44, 119.
[86] Hermann Exner, 'Der Inhalt bestimmt die Form', *Berliner Zeitung*, 22 August 1956, 195 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19560822-0-3-140-0&highlight=Franz.%20Ehrlich%7CFranz%20Ehrlich%7C1956, ZEFYS.
[87] Franz Ehrlich, 'Aufnahme- und Studiogebäude des Staatlichen Rundfunkkomitees', *Deutsche Architektur* 5, no. 9 (1956): 400.
[88] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 20.
[89] Ehrlich, 399.

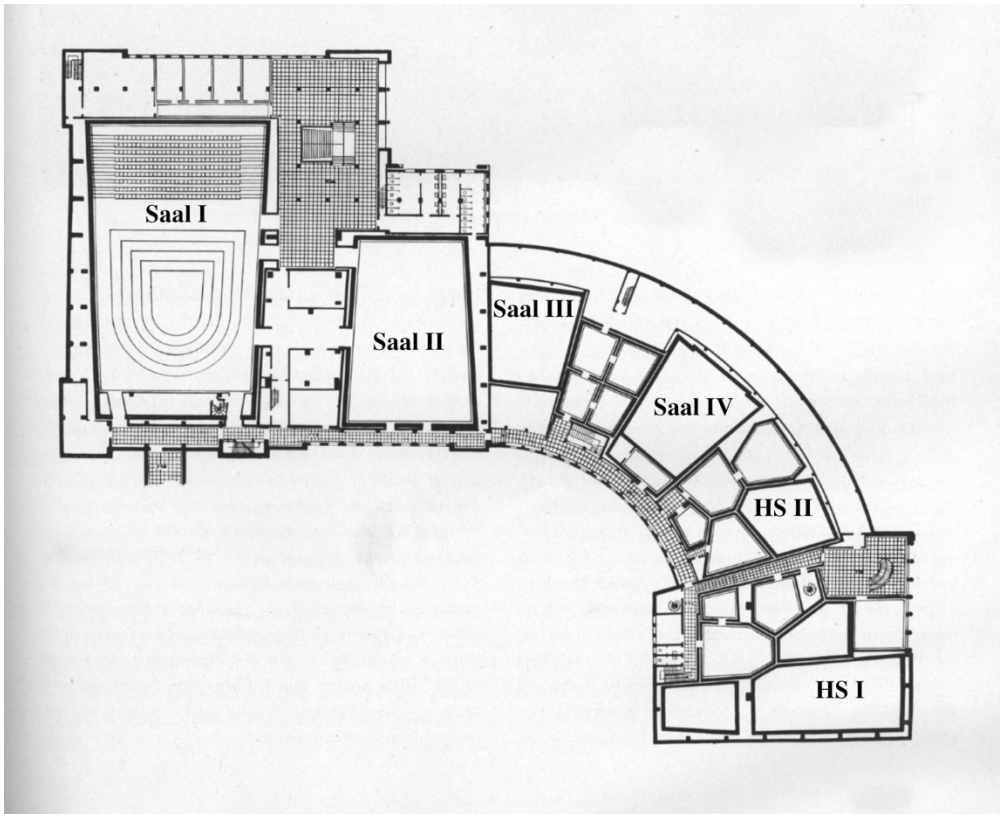

Figure 1.6: Floor plan of Block B with the main recording spaces labelled. The plan shows how the irregular forms of the recording spaces were enclosed within a comparatively regularised and economical building plan.[90]

other parts of the building and non-parallel walls - as found in Sendesaal I - were a feature of all the new Block B recording spaces. Effective acoustic isolation secured the operability of a building running simultaneous recording sessions and non-parallel walls helped mitigate a number of acoustic defects, particularly flutter echoes and standing waves. While the large recording spaces at Haus des Rundfunks occupied semi-independent enclosures within the open spaces surrounded by that building's administrative facade, the layout of Block B was condensed in comparison by laying the six main recording spaces contiguously within a single structure. The irregular floor-plans created by the non-parallel walls utilised in the acoustic designs of the spaces thus became a major factor in the design of the building's layout.

Block B is divided into three sub-sections: two wings or sub-blocks linked by a curved connecting section. Analysis of Block B's studio floor-plans, as depicted in Figure 1.6, within the context of these enclosing sections shows that Ehrlich and Probst used two approaches to incorporate the irregular floor-plans of Block B's studio spaces within a comparatively regular

[90] Ehrlich, 'Aufnahme- und Studiogebäude des Staatlichen Rundfunkkomitees'.

building ground-plan. The first of these approaches was applied to Block B's two largest recording spaces, Saal 1 and Saal 2, housed within the larger of the two wings. Saal 1 and Saal 2 are laid so that the wider end of each of the two quadrilateral spaces lies alongside the narrower end of its counterpart. This maximised the available volume for each recording space within the enclosing structure; beneficial to the acoustic requirements of large scale classical recordings, while also conserving building materials. This general approach to economising the use of space is also evidenced by the location of the marble-clad main entrance foyer within the same the wing as Saal 1 and Saal 2. Water table issues meant Saal 1 and Saal 2 were raised in the design to the first floor.[91] This facilitated the inclusion of the entrance foyer directly below the recording spaces. The second wing at the opposite end of Block B houses the larger of the two radio drama studio complexes, a cluster of small irregular recording spaces enclosed within a largely regular form. These two sections are coupled by a connective building section that also encloses Saal 3 (chamber music), Saal 4 (popular music) and the smaller radio drama studio. This connective section is where Ehrlich and Probst applied their second approach to rationalising irregular spaces within a unified structure. In contrast with the square structure that encloses Saal 1 and Saal 2, here they allowed the quadrilateral recording spaces to direct the layout of this section by arranging the spaces to form a curve. This creates an elegant uniting form for this section of Block B that functionally encloses the recording spaces without material or space wastage. Using these methods, Ehrlich and Probst successfully integrated the specialised forms used by acoustic spaces for recording within a largely-standardised and economic building form.

Externally, Block B largely emulated and took reference from the subdued and functional form of Block A, as well as the nearby Kraftwerk Klingenberg.[92] Block B was conceived and executed at a time when debates over formalism in architecture were reaching their peak in the GDR.[93] Ehrlich was controversial within GDR architectural circles due to his usage of non-functional decorative features and his commissions dwindled during the 1960s.[94] Some aspects of Block B's exterior that can be described as decorative left it vulnerable to such critiques. Ehrlich's defence of the Block B design centred on its unification of architecture and broadcasting technology to form a practical and functional facility, but one which could also

[91] Ehrlich, 402.
[92] Kohlenbach, 'Franz Ehrlich - ein Architekt zwischen Bauhaustradition und DDR-Baudoktrin', 47.
[93] Kohlenbach, 45.
[94] Kohlenbach, 45.

make a creative statement.[95] Economic circumstances in the GDR at the time meant this had to be achieved prudently and Ehrlich was at pains to emphasise the economising measures that informed Block B's construction and decoration. A consistent justification was that Block A and Block B had functionally replaced the extensive capabilities of Haus des Rundfunks at a very reasonable cost. The newspaper *Neues Deutschland* reported that Block B cost half the price of Haus des Rundfunks, although the basis of comparison is not made clear.[96] Justifications of Block B as good value for money were tempered by Ehrlich's assertion that "wir haben die Sparsamkeit nie in enge Knausrigkeit ausarten lassen" ("we have never allowed thrift to degenerate into stinginess"), and some internal decorative features can be directly linked to Ehrlich's belief that spaces for musical performance warranted adornment.[97] The most notable instances of decoration within the acoustic spaces of Block B occur in Saal 1 and Saal 3. These are discussed in turn and in the latter case are suggestive of unresolved hierarchies of regard towards the different genres of music accommodated by Block B. Ehrlich's aversion towards complete functionalism also emerges elsewhere. Although the decoration of the interior of Block B's non-acoustic spaces and access areas was completed quickly and cheaply by using plaster as the predominant finish, more traditional and expensive finishes were used for selected areas; marble and timber finishes were applied in the main foyer and some of the building's break out and reception areas. In addition to the delineation and prioritisation of certain areas by their decoration, elements of Block B's structural layout for acoustic and access purposes appear to promote the segregation of certain forms of audio work. These structural features are also discussed. In some of these cases, technological developments interacted with the original design intentions of spaces in Block B to create new functions and approaches to technical upgrades.

1.2.1 Orchestral Recording Spaces in German Broadcasting Houses

For the design of Block B's interior acoustic spaces, Probst was instrumental in assembling a team that had experience from previous Funkhaus developments. This team was headed by Lothar Keibs, the lead acoustician of Deutsche Post - the governmental

[95] Ehrlich, 'Aufnahme- und Studiogebäude des Staatlichen Rundfunkkomitees', 400.
[96] Hermann Exner, 'Schönheit ohne Verschwendung', *Neues Deutschland*, 28 July 1956, 179 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19560728-0-7-76-0, ZEFYS.
[97] Exner.

communications infrastructure organisation with oversight of Rundfunk DDR - and assisted by Gisela Herzog. Herzog was a member of Deutsche Post's important research unit, the Laboratory for Radio and Television (Betriebslaboratorium für Rundfunk- und Fernsehen) (BRF).[98] At the time of Block B's construction, musical recordings for Rundfunk DDR were being undertaken in ad hoc recording spaces across East Berlin.[99] These included a large room at the Ministry of Finance and a Kultursaal (culture room) at Funkhaus Berlin that pre-dated the Block A renovation.[100] This latter room continued to host occasional recording sessions and received the designation "Saal 5" after the completion of Block B. Block B was constructed to definitively conclude the use of unsatisfactory acoustic spaces for Rundfunk DDR cultural recordings following the loss of Haus des Rundfunks by rationalising and centralising the recording of music and drama in a single location. The capital outlay made during a difficult economic period was justified by its national function; regional broadcasters received technical upgrades during the GDR-era, but Funkhaus Berlin's music and drama production resources were intended to meet the majority of the cultural broadcast production needs for the entire state.

With the exception of Saal 2, the second largest recording space at Block B, all the music recording spaces at Block B were conceptualised along strict genre lines and with little intention for cross-usage.[101] The degree to which the usage of Saal 2 changed and broadened in terms of genre marks it out among the four music recording spaces. Visually resembling a decoratively subdued ballroom and shown in Figure 1.7, Saal 2 was originally intended to be useful for recording the Unterhaltungsorchester and Tanzorchester ("light music" and dance orchestras) popular in Germany during the period of its design.[102] Saal 2 proved to be more flexible than anticipated and was increasingly used for large symphony recordings: originally intended to be the sole responsibility of Saal 1. It also played an important role in introducing stereo recording techniques to popular music at Rundfunk DDR in the early-1960s.[103] While each of the Block B recording spaces warrants an extended analysis, the historical and political significance of pioneering orchestral recording spaces in broadcasting houses like Haus des

[98] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 20.
[99] Stankoweit, 'Studiotechnik Rundfunk: Band II', 87; Eik, *Besondere Vorkommnisse*, 25.
[100] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 20.
[101] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 21.
[102] Steinke and Herzog, 21.
[103] Steinke and Herzog, 21; Referencing for period sources stored at the Deutsches Rundfunk Archiv uses all available assignations but these should not be considered definitive: Gerhard Steinke and Klaus Wagner, 'Stereo-Versuchsaufnahmen mit dem Tanzorchester des Berliner Rundfunks' (Rundfunk und Fernsehtechnisches Zentralamt, 1963), 31/26/2/4, Deutches Rundfunk Archiv.

Figure 1.7: Image of Saal 2 taken from the centre of the space. Saal 2 had perhaps the least rigid genre strictures of any recording space at the time of Block B's inception and it proved to be one of the most flexible. The two doorways depicted lead to the technical service corridor.[104]

Figure 1.8: An image of Saal 1, taken from the main entrance and looking toward the recessed performance area and organ. Saal 1 combined traditional features of concert performance spaces with an unusual approach to the placing of the orchestra.[105]

[104] Cormac Ó Callanáin, *Saal 2*, 1 July 2014.
[105] Cormac Ó Callanáin, *Saal 1*, 1 July 2014.

Rundfunks, added to the ideological weight symphonic music held in the GDR's cultural hierarchy calls for a focus on Saal 1, Block B's largest recording space.

In addition to being the largest, Saal 1 – a partial view of which is reproduced above in Figure 1.8 - is also Block B's most unique recording space, highly specialised to accommodate full-scale performance and recording of symphony orchestra, choir and organ, separately or in tandem. It is Saal 1 that most definitively situates Block B's acoustic designs in a dialogue between progressive innovation and historical emulation, further complicated by the enveloping political context. Saal 1 also explicitly evokes the re-weighting of acoustic design priorities for orchestral music in a broadcasting house undertaken by its designers, who departed decisively from the example of its predecessors and contemporaries. While an examination of Saal 1's distinctive features makes this re-weighting clear, the relative weighting of the causes that resulted in its final form are comparatively difficult to delineate. The contextual backdrop detailed in Part 1 combined with more immediate and functional concerns to create a complicated intermeshing of driving factors: acoustic reprioritisations for practical purposes, opportunities for innovation due to geographical and political considerations, and the facilitation of secondary but well-established functions of performance spaces in broadcasting houses. The most unambiguous alteration enacted by Saal 1 in comparison with its predecessor, Sendesaal I, is the centring of the performers and the recording acoustic in the space's acoustic design and the consequent diminishment of the accommodation made for concert performance or a live audience as part of the recording process. The designation "Saal 1" in itself is a very deliberate departure from its predecessor; the omission of the prefix "Sende" from all the recording spaces at Block B removes the assumption of a live broadcast and acknowledges the shift in practice from live broadcasting concert performances to broadcasting pre-recorded performances, which occurred shortly after Sendesaal I was first inaugurated in the early 1930s.[106] By contrast, the recording and broadcasting spaces of Funkhaus Köln, fully completed in 1952, retain the Sendesaal designation.[107] However, Saal 1's designation only confirms its design priorities, which are hard-coded into its design through a re-configuration of allocated space and novel positioning approaches applied to both performers and audience.

[106] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 21; Lubszynski and Hoffmann, 'The Broadcast Installations in the New "House of Radio"', 1968–69.
[107] Franz Berger, *Das Funkhaus in Köln und seine Gestaltung* (Stuttgart: Alexander Koch GmbH, 1964), 28.

A cursory analysis of Saal 1 could perhaps overlook its underlying radical nature. Of all the Block B recording spaces, its decoration is the most historicised and potentially familiar. Referencing banqueting and guild halls – and perhaps some of the temporary "culture rooms" utilised for orchestral recordings by Rundfunk DDR in the years between Haus des Rundfunks loss and the construction of Block B – the walls and ceiling display prominent pilasters, trellises and decorative cornicing. The specialised function of the room is signalled by a seating bank and an area for musical performance is designated by a recess in the floor, backed by an organ that dominates the space and serves as a visual focal point. Although Ehrlich was not chiefly responsible for the acoustic design of the recording spaces, similar critiques to those directed at him could be made about the ostensibly non-functional decorative features of Saal 1. However, these details had potentially better grounds for defence. Keibs and Herzog could refer to acoustic considerations and historical precedents of good-sounding rooms as the motivation for the decorative features. Although West German acousticians during this period were beginning to rely less on historicised features in their designs, acoustic design in the 1950s - for orchestral performance spaces in particular - remained an incomplete union of empirical modelling predictions, guesswork and direct historical emulation.[108] In contrast with the muted decorative scheme of Sendesaal I between 1933-1956, Saal 1 appears somewhat opulent in comparison, but the majority of the historicised decorative features of Saal 1 have explicitly acoustic functions, alternatively diffusing or absorbing sound to control the acoustic response of the space. More significantly, in making significant departures from the broadcast concert hall model established by Sendesaal I, Saal 1 enacted a radical design agenda that contrasts with its superficially historicised surface.

Saal 1's departure from orchestral broadcasting hall conventions emerges readily in comparisons with its predecessor, Sendesaal I, and close contemporary, the Großes Sendesaal of Funkhaus Köln (now known as the Klaus von Bismarck Saal). Sendesaal I made some of the first integrated technical provisions for the broadcasting of orchestral performances by incorporating audio services into the design of a space largely derived from the example of conventional concert halls. These technical provisions for broadcast were equally utilisable for making orchestral recordings, but fundamental features of Sendesaal I carried over from concert halls were less compatible with the shift to a recording paradigm. The original acoustic design of Sendesaal I served the needs of three demographics: the musicians, the attending

[108] Kohlenbach, 'Franz Ehrlich - ein Architekt zwischen Bauhaustradition und DDR-Baudoktrin', 47.

audience and the broadcast audience (through the intermediation of broadcast engineers). Ideally, the measures taken to optimise the separate acoustic requirements of each of these constituencies can overlap and combine holistically, but changing usage of Sendesaal I exposed unforeseen shortcomings in how these measures were balanced. Musicians and live audiences were well served by Sendesaal I's adoption of many concert hall design conventions. The orchestra performance area was a raised stage with several provisions made for optimally arranging the musicians of the orchestra; a flat front area for the string section and large steps rising towards the rear for other sections of the orchestra. An acoustic shell at the rear of the stage helped direct sound towards the audience but the most fundamental accommodation made for an audience in Sendesaal I was its 1200 seats. As related in the early stages of Part 1, the bare wooden seats of Sendesaal I became problematic as the space was increasingly used as a recording studio, as the absence of the acoustic absorption provided by the audience led to an excessive degree of reverberation.[109] While the inclusion of audience seating in Sendesaal I maintained a historical continuity of practice with the very early days of radio broadcasting and allowed audience applause to be retained as a familiar component of orchestral music broadcasts during the first years of broadcasting from Haus des Rundfunks, the provisions made in Sendesaal I for an attending audience became detrimental to the experience of the far larger audience of a recorded performance.

This particular shortcoming in Sendesaal's I suitability for use as a concert venue and stand-alone recording studio has been addressed in subsequent designs for dual-function orchestral spaces. A common approach in these kinds of spaces is to install heavily upholstered seating as Schallschlucker (sound absorbers), so as to preserve a constant level of sound absorption in the absence of an audience. The 1957 renovation of Sendesaal I by Sender Freies Berlin applied this approach, as did the 1950 650-seat Großes Sendesaal of Funkhaus Köln. Saal 1 in Block B makes prominent use of the upholstered-seating solution, but primarily addresses the functional problem of maintaining an acoustic constant through a reconfiguration of layout that prioritises the recording of the orchestra above accommodating an audience. As with most typical concert halls, audience seating dominates the floor plan of Sendesaal I in comparison to the performance area; the stage in Sendesaal I accounts for less than a quarter of the total floor area, with the remainder given over to the audience seating and overlaid with additional seating in a balcony section. The 1957 renovation altered aspects of the stage and

[109] Stankoweit, 'Studiotechnik Rundfunk: Band I', 18.

seating layout along with the acoustic finishing of Sendesaal I, but largely preserved the stage-to-seating dynamic of the original design.[110] The Großes Sendesaal of Funkhaus Köln is smaller than Sendesaal I, but preserves a similar stage to audience area ratio and also incorporates a balcony.[111]

The re-evaluation of acoustic priorities in Saal 1 is signalled by the inversion of the ratio of performance area to audience area, although this is not in itself an acoustic design solution. The performance area of Saal 1 occupies the vast majority of the available floor space and the remainder accommodates a seating bank of just 260 seats. These features announce the jettisoning by Saal 1's designers of its potential role as a public concert hall so as to focus its design on the primary task of optimising orchestral music performance and recording. This was not a trivial decision and the conceptual significance of the Saal 1 approach has only begun to be recognised outside of former-Rundfunk DDR worker circles.[112] At the time of Saal 1's inception there was no dedicated public concert hall in East Berlin and the link between broadcasting centres and public concert halls was still being renewed by facilities like Funkhaus Köln, which boasted two public concert halls and a public street-facing façade. The geographic location of Funkhaus Berlin mitigated against its suitability as a concert venue. While not particularly distant from central Berlin, Funkhaus Berlin was relatively inaccessible to the public and did not have transport links comparable to the urban location of Haus des Rundfunks. The relative isolation of Funkhaus Berlin is attested to by how it was safeguarded from attention during the 1953 Uprising and recurring accounts of visiting performance ensembles turning up late for recording sessions due to trouble finding it.[113] Eliding the concert hall role allowed Saal 1 to occupy its own design niche. Sendesaal I was originally designed for the live broadcast of concert music before a live audience. Saal 1 was designed to take full advantage of developments in sound recording since the 1930s; it is a room designed for the age of tape recording, which allowed orchestral performances to have enduring utility and value for broadcasters beyond their original performance by providing a source of broadcast material independent of record companies. While Sendesaal I (after its renovation) and the

[110] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 177.
[111] Berger, *Das Funkhaus in Köln und seine Gestaltung*, 44.
[112] Alfredo Thiermann, 'Radio Activities', *Thresholds*, 1 August 2017, 203.
[113] Horst Nutscher, 'Versuchsbericht 345/7 b: Bericht Über Kunstlerisch-Technische Fragen Im Block "B"' (Rundfunk und Fernsehtechnisches Zentralamt, 6 October 1956), 8, 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.

Figure 1.9: The seating bank in Saal 1. The density of the bank and the bulky upholstery of the individual seats indicate their acoustic purpose and point towards a presumption of infrequent usage.[114]

Großes Sendesaal of Funkhaus Köln make substantial provision for dual usage, the Saal 1 acoustic design is much more committed to servicing a listenership beyond the confines of its walls.

Recording spaces for orchestra without seating are not unusual. One of the most famous orchestral recording spaces in the world is Abbey Road's Studio One, which makes no permanent provision for an audience. Saal 1 is difficult to align with such studios. Its construction and ownership by a broadcaster rather than a record company, in addition to its unusual connection to Sendesaal I, places it within a different lineage. Classification of Saal 1 is further complicated by its vestigial seating bank, shown in Figure 1.9. In the context of both Sendesaal I and the Großes Sendesaal, 260 seats for a symphony orchestra performance space could potentially exclude it from categorisation as a concert hall, but it is not an insignificant number and the seating bank has an appreciable presence within the space, even while vacant. While the design departures of Saal 1 in favour of its recording audience were bold in the context of other broadcasting houses, the seating bank indicates Rundfunk DDR was not prepared to completely relinquish the capability of hosting live performances. Even if the capacity of such a capability was greatly reduced, it could still be utilised for special

[114] Cormac Ó Callanáin, *Saal 1, Seating Bank*, 1 July 2014.

performances for invited guests or visiting dignitaries, during a period when the GDR had no dedicated concert hall in East Berlin.[115] The marble entrance foyer, the historicised décor of Saal 1 and its seating bank can all be linked back to this purpose. However, in their execution, these accommodations for live performance reveal themselves as decisively subordinate to Saal 1's primary design goals. Block B's main foyer, clad in expensive materials, introduces a procession of columns that lead towards a large staircase and the Saal 1 entrance foyer. However, the cramped height of the ceiling in proportion to its length and the awkward natural side-lighting of this entranceway are indicative of its origins as an opportunistic use of auxiliary space leftover from the necessary placement of Saal 1 and Saal 2 on the first floor. The functionality of the main foyer was further undermined by the foot-bridge that connects Block A and Block, built during the early-1960s. The design of the seating bank itself is equivocal towards the regular presence of an audience. The seats are even more heavily upholstered than the seats of the Großes Sendesaal at Funkhaus Köln and other comparative dual orchestral performance and recording spaces. They are steeply raked and tightly packed to form a single stable acoustic body and their redundancy was largely confirmed by the scarcity of usage they received. During the GDR-era, Saal 1 never hosted a public concert and the rare invited-audience performances for which the seats were intended ceased entirely from the mid-1960s.[116] This noncommittal approach to facilitating live concert performance at Saal 1 preserved its overriding design aims, but also locate it within an uncertain space between recording studio and concert hall. These heavily under-utilised and largely superfluous seats, nonetheless remain a present and important feature of the space. While the design of Saal 1 greatly reconfigures the role of an attending audience in favour of an audience that is not physically present, the spatial relationship and dynamic between performance space and audience space is still preserved and has to be approached in when considering Saal 1's most distinctive and radical feature: the Orchesterwanne (Orchestral Tub).

1.2.2 The Orchesterwanne and Contested Acoustics

Many features of Saal 1 distinguish it from other broadcasting halls and recording studios, but none more so than its innovative positioning of the orchestra. Standard practice in

[115] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 21.
[116] Steinke and Herzog, 21.

concert halls places the orchestra on a raised stage or platform for both acoustic and sightline considerations, with the back rows of orchestral sections often further raised on rostra or additional levels. Sendesaal I, the Großes Sendesaal and the concert hall at BBC Broadcasting House all exhibit these features. The rebalancing of priorities in Saal 1 presented an opportunity to trial a radical new approach for spatialising orchestra within a recording space. The Orchesterwanne was a suggestion of Siegfried Mitlacher, Rundfunk DDR's Cheftonmeister (chief sound engineer) during the construction of Block B and executed by the BRF acoustic consultants.[117] The Orchesterwanne does stagger the orchestra in line with convention, but inverts the direction of travel. Instead of raising the orchestra higher from stage level, each row of the Orchesterwanne descends progressively further into the ground. The layout of the Orchesterwanne facilitates the familiar arrangement of orchestral musicians without resorting to mobile rostra or a fixed stage, but it is also an essential component of the Saal 1 acoustic concept. The steps themselves, in conjunction with the lower sections of Saal 1's walls, provide early sound reflections for the musicians to comfortably monitor their playing. The upper, more elaborate sections of Saal 1 function to develop the broader sound of the space. The plaster pilasters and cornice-work act as diffusers, while the lattice-covered rockwool and fabric sections of the wall help control the degree of reverberation by absorbing sound.[118] Rockwool-filled semi-cylinders on the ceiling combine diffusive and absorbent qualities.[119] Together these features work towards dual, complementary purposes: the creation of an optimised acoustic environment for musical performance, within a broader sound field enhanced for recording.[120] Despite the specific and innovative provisions made in the space for musical performance, it was a contingent of orchestral musicians and conductors that proved most resistant to accepting the suitability of the new recording space during its initial use and who mounted a challenge to the validity of the Saal 1 design.

During 1956 and 1957, extensive recording sessions were conducted at Block B to evaluate the recording spaces and technical procedures as the facility transitioned from initial trials into full production. Recording sessions were undertaken with all the major Rundfunk DDR ensembles, as well as a number of popular GDR dance orchestras. International ensembles and singers from Poland and the ČSR were also recorded during this period, along

[117] Steinke and Herzog, 37.
[118] Steinke and Herzog, 49.
[119] Steinke and Herzog, 49.
[120] Steinke and Herzog, 42.

with the Italian tenor Gianni Poggi.[121] It was during this transitional period that Gerhard Steinke started to gain prominence within the acoustic and technical narrative of Rundfunk DDR and commenced a long association with Funkhaus Berlin. Appointed as the leader of a problem-solving unit within the BRF in 1956, Steinke established his reputation with his involvement in the development of an early synthesiser, the Subharchord.[122] Not directly involved with the design or construction of Block B, Steinke was tasked with overseeing the development of recording practices in the new facility during its first two years of operation.[123] Steinke was closely involved with the formation of the Rundfunk DDR Hörgruppe (listening group) for "die subjecktive Bewertung akustisch-musikalischer Probleme sowie für Kontrolle der gesamten Musik production" ("the subjective evaluation of acoustic-musical problems and the management of all music production").[124] The membership of the Hörgruppe was drawn from a broad cross-section of workers with audio and musical expertise including the BRF, Rundfunk DDR sound engineers, technical and production staff and music department staff. From 1956, weekly meetings were inaugurated that analysed and discussed Block B's recorded output and worked towards establishing internal standards and shared means of assessment.[125] Steinke regarded the Hörgruppe as a route towards aligning Rundfunk DDR with international best practice and also foresaw a role for its members in conducting international visits and collaborations and preparing Rundfunk DDR for impending audio technology developments, such as stereo.[126] The Hörgruppe became an important resource for maintaining and advancing procedures and technical standards at Rundfunk DDR; in the 1970s its remit was expanded to allow it to contribute to major sound reinforcement projects in the GDR, detailed in Chapter 4. By the end of 1956 thorough assessment of the Block B recording spaces resulted in only a small number of minor adjustments, mostly to reverb chambers and elements of the radio drama complexes.[127] The first alteration made to the acoustic response of any of the music recording spaces was a slight extension of the reverberation time of Saal 2 at 1000 Hz, likely achieved by the trial and error manipulation of the absorptive material backing the space's modular wall panelling.[128] While this end-of-year assessment was an emphatic validation of the work of the Block B acoustic designers, responses by Rundfunk DDR musicians and

[121] Nutscher, 'Versuchsbericht 345/7 b: Bericht Über Kunstlerisch-Technische Fragen Im Block "B"', 8–9.
[122] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 240.
[123] Steinke and Herzog, 34.
[124] Gerhard Steinke, 'Versuchsbericht 345/12: Jahresbericht' (Betriebslaboratorium für Rundfunk und Fernsehen Labor 345, 11 January 1957), 3, 31/26/2/4, Deutches Rundfunk Archiv.
[125] Steinke, 3.
[126] Steinke, 4.
[127] Steinke, 3.
[128] Steinke, 3.

conductors to the Saal 1 acoustic earlier in the year led to a brief but factious dispute between musical and technical staff.

The BRF's own empirical analyses of Saal 1 in early 1956 were broadly positive, but musicians from the Rundfunk DDR orchestral ensembles began to complain about "Hörbarkeit" ("audibility") problems almost immediately.[129] Some of these complaints focussed on the form of Saal 1 and the orchestra's placement within it, core to its innovative approach.[130] These complaints were taken seriously by the BRF at first and practical efforts were made to address them by improving early reflections within Saal 1 through the introduction of additional temporary reflective surfaces.[131] These efforts did not halt complaints and the situation appears to also have been an expression of generalised tensions between technical recording staff and the members and conductors of some of the performance ensembles. An employee of the BRF, Horst Nutscher, wrote a detailed, though partisan, account of interactions between technical staff and the Rundfunk DDR performance ensembles during this period. Usually based in Dresden, Nutscher was assigned to trial recordings conducted in Block B between January and May 1956.[132] Initial responses from the conductors of the Rundfunk DDR ensembles were largely negative. Helmut Koch, the choir master of the Großen Chor des Berliner Rundfunks (Berlin Radio Large Chorus), reportedly suggested that anyone recording or rehearsing in Saal 1 was a "Scharlatan" ("charlatan"), although Nutscher does not elaborate on the rationale behind Koch's comment.[133] Nutscher considered Otto Dobrindt, conductor of the Unterhaltungsorchester des Berliner Rundfunks (Berlin Radio Light Orchestra), difficult to deal with and he was associated with a comment that was picked up by other conductors and musicians and regularly directed at technical staff around this time: "die Technik versklavt die Kunst" ("technology enslaves art").[134] This criticism encompassed sound engineers and technicians along with microphones and other recording technologies, but may have been particularly directed at the recording staff's insistence on technical rehearsals.[135] Hermann Abendroth, the chief conductor of the Berlin Rundfunksinfonieorchester, was more collegial. He reportedly warmed to the acoustic of Saal 2 first, after witnessing a trial recording of the Adolf Fritz Guhl Orchestra, and subsequently attempted to have a Rundfunksinfonieorchester

[129] Nutscher, 'Versuchsbericht 345/7 b: Bericht Über Kunstlerisch-Technische Fragen Im Block "B"', 1, 3.
[130] Steinke, 'Versuchsbericht 345/12: Jahresbericht', 3.
[131] Steinke, 3.
[132] Nutscher, 'Versuchsbericht 345/7 b: Bericht Über Kunstlerisch-Technische Fragen Im Block "B"', 2.
[133] Nutscher, 2.
[134] Steinke, 'Versuchsbericht 345/12: Jahresbericht', 3.
[135] Nutscher, 'Versuchsbericht 345/7 b: Bericht Über Kunstlerisch-Technische Fragen Im Block "B"', 2.

Figure 1.10: A choir rehearsal in Saal 1 c. 1958. The empty chairs in the image depict how an orchestra was placed within the Orchesterwanne for a mono recording during this period.[136]

session moved there. [137] Rolf Kleinert, initially the deputy conductor of Berlin Rundfunksinfonieorchester until Abendroth's death in May 1956, was particularly critical of the Saal 1 acoustic and obstructed the recording of orchestral rehearsals.[138] Nutscher identified him as the most committed source of criticism and claimed he galvanised resistance to Saal 1 among musicians.[139] Nutscher reported him as claiming that his orchestra would be "versaut" ("soiled") for several months if they ever rehearsed or recorded in Saal 1 again.[140]

The dispute escalated before its eventual resolution; Nutscher claimed that the Rundfunksinfonieorchester attempted to mobilise an unnamed West German conductor to visit Saal 1 and speak out against the space.[141] Additionally, Franz Konwitschny, the conductor of the Leipzig Gewandhausorchester, was briefed against Saal 1 ahead of his arrival for a recording session.[142] When he became aware of this, Nutscher contacted Konwitschny directly, with whom he had an existing professional relationship, in an attempt to counter-balance the negative representations.[143] After conducting his session, Nutscher reported that Konwitschny came out in favour of the Saal 1 acoustic.[144] In continued efforts to respond to the musician's complaints that they could not hear each other ("hört sich einander nicht"), time was allocated

[136] 'Besuch in unseren modernen Hörspielstudios'.
[137] Nutscher, 1; Steinke, 'Versuchsbericht 345/12: Jahresbericht', 3.
[138] Nutscher, 'Versuchsbericht 345/7 b: Bericht Über Kunstlerisch-Technische Fragen Im Block "B"', 1.
[139] Nutscher, 3.
[140] Nutscher, 3.
[141] Nutscher, 3.
[142] Nutscher, 3.
[143] Nutscher, 3.
[144] Nutscher, 3.

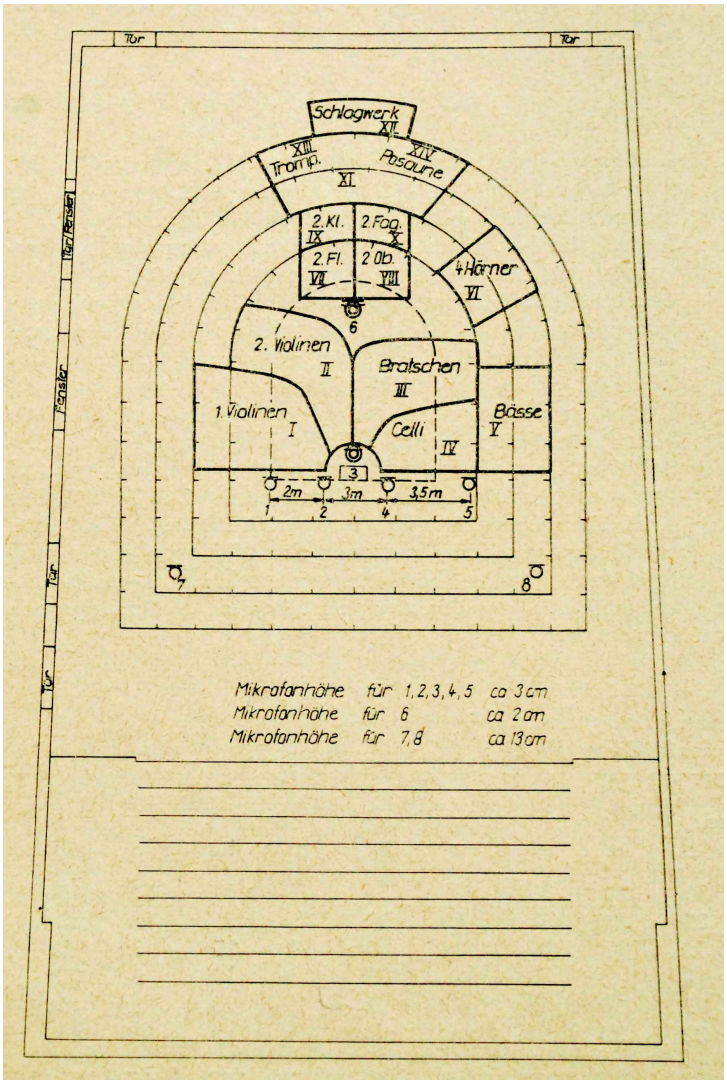

Figure 1.11: An instrument and microphone layout of Saal 1 from 1967 for a stereo recording of orchestra without choir. The transition to stereo recordings required new equipment but also the reconsideration of how instruments were placed in the space.[145]

for comparative test recordings that placed the orchestra in different locations within Saal 1.[146] The musicians had advocated for a seating arrangement that placed them in a corner of Saal 1, as they believed this would provide the best conditions for mutual audibility during recording.[147] This configuration instead produced the least musical recording ("die musikalisch schlechteste Aufzeichnung") of these positional trials, which appears to have been recognised by the musicians and the dispute de-escalated from this point.[148] Sessions resumed with the

[145] Klaus Wagner, 'RFZ Mitteilungen Informationen: Zum gegenwärtigen Stand der stereofonen Aufnahme- und Übertragungstechnik für Musik' (Rundfunk und Fernsehtechnisches Zentralamt, May 1967), 10, 31/26/1/5, Deutches Rundfunk Archiv.
[146] Nutscher, 3.
[147] Nutscher, 3.
[148] Nutscher, 3.

Figure 1.12: A detail of the Orchesterwanne, with the filled-in lowest step partially discernible in the centre. Altered during the early stages of its usage, this renovation was the only significant physical alteration made to the acoustic design of Saal 1.[149]

orchestra configured within the Orchesterwanne (examples of conventional arrangements from the 1950s and 1960s are imaged in Figure 1.10 and 1.11) and both Kleinert and Koch appeared to settle into and accept Saal 1. The episode seemed resolved by June 1956, with Nutscher declaring: "Saal 1 nach heissen Kämpfen "hörbar" (ist)" ("after heated struggle, Saal 1 (is) "audible"").[150] Nutscher attributed the genesis of the quarrel to discipline problems within the performance ensembles, but also acknowledged an existing antagonistic relationship exacerbated by an absence of tact on the part of technical staff.[151]

Criticism of the Saal 1 acoustic by musicians and conductors was initially generalised, but the subsequent focus on the orchestra's layout suggests that the unfamiliarity of the Orchesterwanne layout was a factor. This is borne out by details of the single permanent alteration made to Saal 1 as an outcome of the dispute, the filling-in of the lowest step of the Orchesterwanne - just visible in Figure 1.12.[152] While not a drastic alteration to the overall acoustic design of Saal 1, this reconfiguration of the Orchesterwanne provided additional space on its lowest level that facilitated an improved arrangement of the string sections and helped

[149] Cormac Ó Callanáin, *Saal 1, Orchesterwanne*, 1 July 2014.
[150] Nutscher, 12.
[151] Nutscher, 2.
[152] Steinke, 'Versuchsbericht 345/12: Jahresbericht', 3.

to appease the musicians' concerns about audibility. This action is significant not just because it marked the end of the dispute between musicians and technicians; the most distinctive expression of Keibs, Herzog and Mitlacher's collaboration weathered a concerted critiquing with just a single alteration to its most novel aspect. Subsequent to this alteration, Saal 1 proved to be among the most stable acoustic designs of Block B during its use by Rundfunk DDR, a further endorsement of their innovative approach.

That the resolved dispute returned the orchestra to its original placement within the Orchesterwanne invites final consideration of the dynamic between the performance and audience functions of Saal 1. The performance area within the space allowed enough flexibility for several performance configurations to be considered, as evidenced by the experimental layouts reported by Nutscher. However, the acoustic designers' intentions – encoded into the space by the construction of the Orchesterwanne and its single curved end – impose a pre-determined optimised arrangement of the orchestra within the space that preserves a familiar positional relationship between the performers and the potential audience of the seating bank. The significance of this positional relationship in the context of Saal 1 and its contribution to the optimal use and acoustic outcome of the space was confirmed by the combative approval process that attempted to drastically modify orchestral positioning away from the designers' intentions. Although the Orchesterwanne came about as part of Saal 1's broad departure from the conventions of standard concert halls and is a stark visual designator of this design tangent, it simultaneously reinforces the space's engagement with aspects of the concert hall model through its interaction with the seating bank. A radical reconfiguration of the audience and performer positional dynamic in concert halls was successfully applied by the enwrapment of the performance area by audience seating on all sides at the Berliner Philharmonie concert hall in West Berlin in 1963. The Philharmonie was influential on concert hall design in East Germany and beyond and is discussed in the context of GDR performance venues in Chapter 4, but Saal 1 can be interpreted as a foreshadowing of this "democratised" acoustic due to its extensive efforts to serve a wide listenership.

1.2.3 Ideological Undercurrents in Block B Structural and Decorative Elements

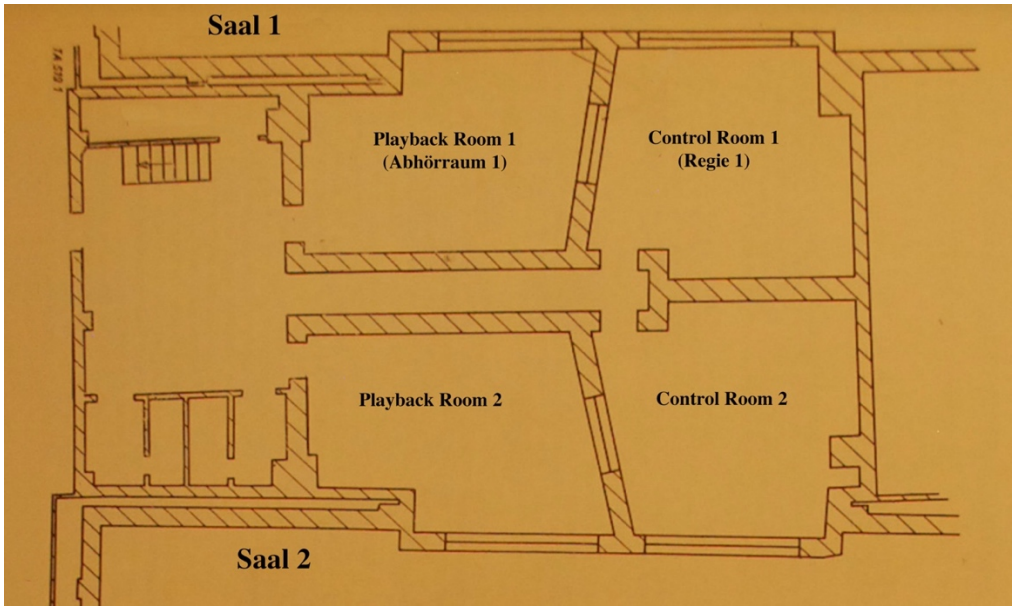

Figure 1.13: The original designations and relative layout of the Saal 1 and Saal 2 technical rooms. The additional capacity of the playback rooms proved useful at several junctures in Block B's history by allowing major technical upgrades to be undertaken without sacrificing existing functionality.[153]


Figure 1.14: A view from the floor of Saal 2 towards the control space originally designated as Abhörraum 2 (Playback Room 2). The original Regie 2 (Control Room 2) is also just visible to the right. The control and playback rooms of Saal 1 and Saal 2 had equally good visual access to the recording spaces - enhancing their flexibility.[154]

[153] Gerhard Steinke, Wolfgang Hoeg, and M. Wasner, 'Einrichtung eines Experimental-Regieraumes für Mehrkanal-Aufnahmetechnik im Funkhaus Berlin Oberschöneweide', *RFZ Information*, September 1963, 31/26/1/3 - 31/26/1/6, Deutches Rundfunk Archiv.
[154] Cormac Ó Callanáin, *Saal 2, Playback Room 2*, 1 July 2014.

The design impulses that influenced the form of Saal 1 can be interpreted as technologically and politically progressive. They applied new concepts alongside proven techniques to create a space optimised for producing recordings and skipped the opportunity to have a new concert hall in East Berlin in order to prioritise recording practices that could benefit a broader public listenership. However, the confluence of design influences and political and economic factors that resulted in Saal 1's progressive form were not expressed uniformly throughout Block B. While the design of Saal 1 and the other recording spaces were directed towards unifying performers with radio listeners, some other co-existing design elements of Block B express impulses that attempt to partition different kinds of work or performance, which can be interpreted as conflicting with socialist ideals.

The dispute over the attributes of Saal 1 and the layout of the orchestra within that space brought tensions between technicians and musicians to the fore, but these pre-existed the move to Funkhaus Berlin. An awareness of these problems may have instigated a major feature of the Saal 1 and Saal 2 control spaces. The co-location of Saal 1 and Saal 2 allowed the placement of a shared, acoustically isolated, control room complex in the void between the two large recording spaces. The most distinctive feature of these control spaces is the assignation of two control rooms to each recording spaces, both of similar size and design with visual access to the corresponding recording space through large sound-insulated windows. The layout and an external view of one of the control rooms are given in Figures 1.13 and 1.14. Initially, one each of these served as the recording control room for the adjacent recording space, with the ancillary rooms serving as Abhörräume (playback rooms) to allow orchestra conductors and other non-technical decision-makers to listen back to recording takes independently of the recording engineers and tape operators. This generous allocation of space to analytical listening is noteworthy in the context of both broadcasting houses and commercial recording studios, where space is typically at a premium. The attachment of independent listening rooms for artistic assessment was justified as an innovative and functional approach for facilitating recording sessions, but the partitioning of technical and artistic audio workers also occurs elsewhere in Block B.

Figure 1.15: A view of the main access corridor of Block B. This corridor is wider and features more natural light than the parallel service corridor on the other side of the building.[155]

The most fundamental aspects of Block B that enact a segregational impulse are the two parallel curved corridors that run on either side of the building's central connecting section and which link the two wings of the recording complex. The two corridors contrast each other markedly. The main corridor, pictured in Figure 15, links through from the main foyer to the smaller musical spaces and radio drama complexes. One of the brightest spaces in Block B, the corridor faces south-west over the Spree, features floor-to-ceiling windows and was featured in photographs that accompanied Ehrlich's own 1956 article on the design of Block B.[156] This corridor was intended as access for the musical and acting talent working at Block B. As indicated on the floor plan reproduced in Figure 16, the main corridor is mirrored on the opposite side of the building by a narrower, darker, service corridor for technical staff and services. Ehrlich explicitly recognised this active partitioning and justified it on practical grounds of technical logistics and safety, but he also qualified it by stating "dieses System

[155] Cormac Ó Callanáin, *Main Access Corridor*, 1 July 2014.
[156] Ehrlich, 'Aufnahme- und Studiogebäude des Staatlichen Rundfunkkomitees', 407.

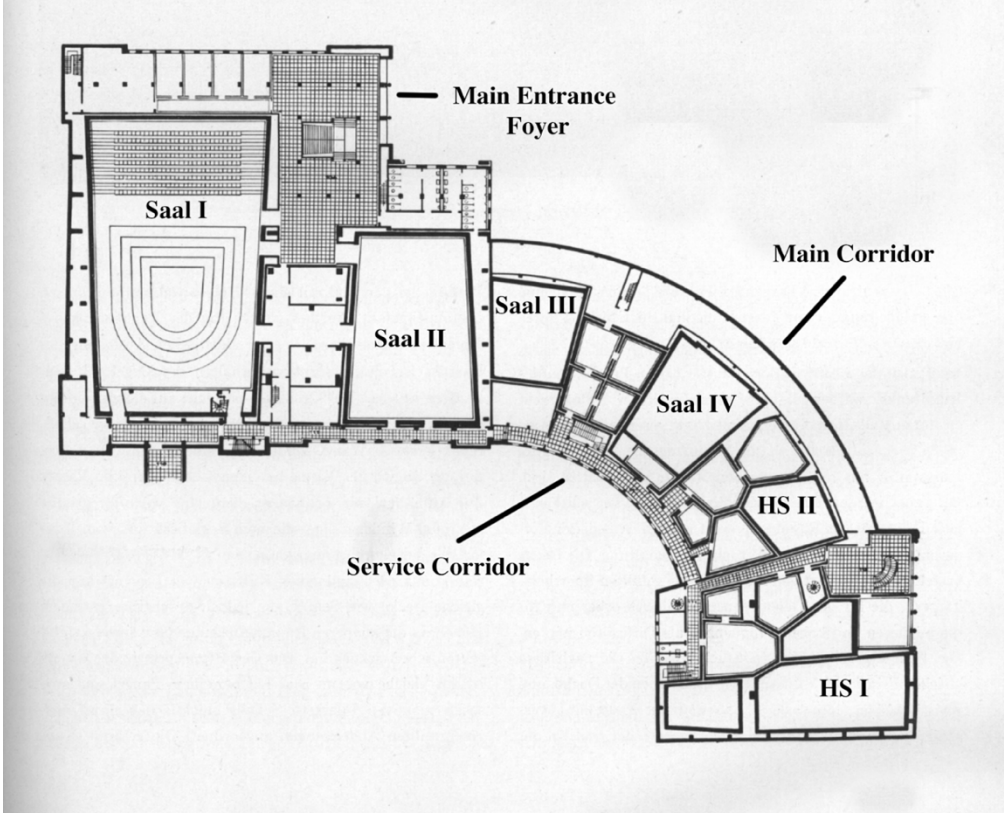

Figure 1.16: Floor plan of Block B with some of the primary access features labelled. The relative floor plans of the two parallel corridors can be discerned, indicating how Block B had differentiated accessways.

schuf organisch die notwendige Trennung zwischen technischen und künstlerischen Mitarbeitern" ("this system organically enables the necessary segregation of artistic and technical workers").[157] While Funkhaus Köln includes two concert halls that require the facilitation of public access, it does not exhibit a similar degree of partitioned or duplicated access. Ehrlich also endorsed delineations of esteem demarked by a particular decorative feature of one of the Block B recording spaces. Apart from Saal 1, Saal 3 has the most historicised decorative scheme in Block B. Most of the finishing in Saal 3 has explicitly acoustic functions, but, unique to this space, a fleur-de-lis motif is painted onto the stretched artificial leather wallpaper and other sections of the walls. Unlike Saal 1, Saal 3 has no permanent provision for a live audience and Ehrlich instead justified the decorative elements in this particular studio by reference to the calibre of the chamber musicians that would play there:

[157] Ehrlich, 'Aufnahme- und Studiogebäude des Staatlichen Rundfunkkomitees'.

> Die mit Goldmalerei versehene Kunstledertapete im Kammermusiksaal, die übrigens ebenfalls akustische Aufgaben hat, ist ein Aufwand, der für diesen bestimmten Raum, der den qualifiziertesten Musikern zum Arbeitsraum dient, wichtig ist.[158]
>
> The artificial leather wallpaper in the chamber music hall, which is decorated with gold-painting, also has an acoustic function; but it is a detail which is important for this particular room, which serves the most qualified musicians in the field.

These varied and potentially contradictory features within the holistic Block B design, along with the formalist critiques Ehrlich received, suggest an incomplete integration of GDR design orthodoxies. These were still being formed contemporaneously and the unification of the GDR's cultural and socialist missions in acoustic and architectural design was executed more rigorously in later decades in structures like the Palast der Republik, discussed extensively in Chapter 4. These discordant elements do provide some degree of insight into design and architectural approaches and priorities as applied to a rigorous and specialised purpose under time and material constraints and during a formative period in GDR history. Also of note is how the implications of the above highlighted design features were largely overridden by the practices and procedures developed at Funkhaus Berlin, which reinterpreted available space in line with practical considerations over the following decades. One of the most visible and lasting departures from the original delineations of Ehrlich and Probst's technical layout was the redesignation of the Saal 1 and Saal 2 control spaces.

The original usage of the playback rooms did not last long. In the early 1960s, upgrading technical recording capabilities at Block B took precedence and the playback room for Saal 1 was converted into Rundfunk DDR's first stereo-capable control room and then run in tandem with the original mono-equipped control room. This established a regular procedure for upgrading recording facilities in Saal 1 and Saal 2 and the playback rooms offered important operational flexibility for both recording spaces, discussed in more detail in Chapter 3. Additionally, the segregation of technical and artistic recording work as a work-flow concept enacted by the functional divisions of the Saal 1 and Saal 2 control spaces was consistently rejected by the new generation of technical radio personnel that developed their practice at Funkhaus Berlin. One of the earliest broad developments to recording practice undertaken by

[158] Exner, 'Schönheit ohne Verschwendung'.

the Hörgruppe was addressing what they considered to be the unsuitability of the then-current division of technical responsibility for recording sessions. Influenced by observations on perennial communication problems between Toningenieurs (sound engineer/sound technician) and Tonmeisters (producer/sound engineer) during sessions, the Hörgruppe sought to merge the roles in line with developing practice in Italy and West Germany.[159] Steinke advocated a pedagogical approach by offering musical education opportunities to sound technicians, inspired by a female technician for the Bruno Saenger Orchestra who was able to rise to the position of Tonmeister by undertaking musical training to augment her technical competencies.[160] The Hörgruppe developed broad training opportunities for Rundfunk DDR staff alongside its main activity of overseeing recording standards, but its activities met some resistance. Nutscher wrote that he and Steinke were seen as "lästige Störenfriede" ("annoying troublemakers") in a workplace that had imported rigidly established technical practices and which initially resisted the presence of women at technical rehearsals, but the Hörgruppe persisted in its pursuit of continuous development procedures and Rundfunk DDR came to rely on a large proportion of technicians who were women.[161]

Finally, although Ehrlich's comments on Saal 3 confirm there was some disparity in the relative esteem afforded the various forms of music recorded at Block B, the provisions made by genre were diverse for the era and technically and acoustically fit-for-purpose. Popular music eventually received specific technical attention as the commercial and artistic value of popular music was better acknowledged in the GDR from the 1970s. During the 1980s, a major research effort to develop a digital mixing desk (System 2000) capable of handling the kinds of large sessions demanded by developments in popular music was first trialled in the Saal 4 space. This was a marked turnaround from previous decades when all technological improvements focussed almost exclusively on improving classical music recordings in the first instance. This had been the case with advances like stereo and the introduction of transistor-based equipment, but popular music did receive consistent attention in Rundfunk DDR upgrade schedules. Technical facilitation of popular music recording contrasted well with provisions made for electro-acoustic music, which was among the most restricted musical genres under GDR orthodoxy. Concerted attempts by Steinke and others to establish an electro-acoustic lab

[159] 'Versuchsbericht 345/8: Zwischenbericht für Kom.-Nr. 5226 Betreung der Tonmeister und Toningenieure' (Betriebslaboratorium für Rundfunk und Fernsehen Labor 345, 29 October 1957), 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.
[160] Steinke, 'Versuchsbericht 345/12: Jahresbericht', 2.
[161] Nutscher, 'Versuchsbericht 345/7 b: Bericht Über Kunstlerisch-Technische Fragen Im Block "B"', 11.

during the 1950s were thwarted, but electro-acoustic approaches and the BRF-developed Subharchord were used to provide backing music for radio dramas.[162] The rigidity of the Block B genre assignations blurred somewhat over time and even Saal 1 found extended application beyond its primary symphonic remit during the GDR-era.[163] The current status of Funkhaus Berlin as a privately-owned cultural production and event space has extended the genre distribution within the Block B spaces far beyond any projection of the original designers. Saal 1 has hosted corporate music events utilising large sound reinforcement systems and the smaller music recording spaces and radio drama complexes host a diverse spectrum of music recording studios.[164] Most of these uses continue to confirm the viability of the holistic acoustic concepts applied at Block B.

1.2.4 Conclusion

Funkhaus Berlin and Block B proved their functionality over forty years of broadcasting and recording, but this analysis attempts to draw out the degree to which they were embedded within historical acoustic and contemporary political narratives particular to the GDR. Funkhaus Berlin is indicative of the GDR's impressive technological and cultural broadcasting capabilities, but it can also be seen as emblematic of a loss of political initiative within GDR broadcasting or a component of a deceit conducted by the GDR upon its citizens and radio workers. The first decade of East German broadcasting was characterised by the forced deconstruction of broadcasting infrastructure it had initially claimed and the volatile altercations that accompanied East German broadcasting during this period are an inescapable component of the formation of Funkhaus Berlin. Rundfunk DDR constructed a lineage that emphasised the activities of its broadcast workers in the overthrow of fascism and genuine traumatic and combative experiences for Rundfunk DDR staff during the 1950s were fed into its institutional memory as motivational anti-capitalist grievances. This narrative of besiegement was considered valuable enough to be opportunistically extended by the transformation of a workplace accident into one of the most notorious acts of sabotage in GDR

[162] Gerhard Steinke, 'Abschclussbericht: Bericht über eine Studienreise nach Köln' (Betriebslaboratorium für Rundfunk und Fernsehen, 1957), 31/26/2/4, Deutches Rundfunk Archiv.
[163] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 21.
[164] Ulrich Gutmair, 'Meet Funkhaus's Former Head of Sound Technology', Red Bull Music Academy Daily, 10 September 2018, http://daily.redbullmusicacademy.com/2018/09/gerhard-steinke-funkhaus-berlin-sound-technology.

history. This overarching narrative influenced a defensive infrastructural stance, embodied in Funkhaus Berlin's location and reflected in Rundfunk DDR's journalistic approach, contrasting starkly with the Soviet-sponsored infrastructural and journalistic initiative Rundfunk DDR's predecessor organisation possessed in the immediate post-war period. This defensive configuration helped to provide the opportunity for acoustic designs that combined established and experimental acoustic approaches.

Haus des Rundfunks' Sendesaal I made important strides for radio broadcasting acoustics and Saal 1's deviations from its example emphasises the contextual aspects of its formation, discussed extensively in this analysis. The Saal 1 design prioritises performers and a broad listenership, but interpretation of this clearly-signalled departure is complicated by decorative references to historical performance contexts and a restrained accommodation for a potential live audience. The historical references of Saal 1 nonetheless cloak a substantial diminishment in the provisions the space makes for a privileged live audience that can be regarded as demarking it in some senses as a progressive, though physically inaccessible, cultural space. Determining the public impact of this space's unique attributes is beyond the scope of this investigation, but its contribution to a nationalised soundscape may be worth considering in comparison with the recognised influence of other national radio networks.[165] Saal 1's "socialist acoustic" can also be positioned within Block B's contributions to the development of a "socialist" approach to architecture and design, but problematic divisions of labour and prestige within the hierarchies of space in Block B suggest a slightly distorted application of GDR ideology. However, these were not disruptive to activities at Block B and these elements were steadily overridden or adapted by the progressions of practice over time.

Chapter 4 of this thesis discusses the performance venue within the Palast der Republik - a more coherent union of GDR cultural and architectural ideologies - which emphasised the inclusion of a diverse audience and which responded to the "democratised" acoustic of the Berliner Philharmonie using technological means. Linking Block B and the Palast der Republik raises interesting questions regarding GDR design approaches to specialisation and flexibility in cultural and performance spacess. Saal 1's uniqueness is predicated on the specific degree to which it specialised towards a single purpose, while the performance venue of the Palast der

[165] Emily Ann Thompson, *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (Cambridge; London: MIT Press, 2002), 301.

Republik is unique due to the degree and manner in which it accommodated a wide range of uses. Other venues constructed and restored during the GDR-era, including the Leipzig Gewandhaus, Kulturpalast Dresden and the Konzerthaus Berlin, pose similar questions. Saal 1's liminal position between concert hall, broadcast hall and recording studios, may allow it to be placed within such a discussion.

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Chapter 2:

Deutsche Schallplatten: Records and Recording in the GDR, 1949-1990

> Die Schallplatte gewinnt damit eine außerordentliche Bedeutung als Mittel der Kulturpropaganda, das noch dazu den Vorteil hat, sich selbst zu finanzieren und unter Umständen sogar Devisen einzubringen. Es muß allerdings betont werden, daß auf dem internationalen Markt nur Langspielplatten von hervorragender Qualität Aussicht auf Erfolg haben.[1]
>
> The gramophone record has gained extraordinary importance as a means of cultural propaganda. It has the advantage of being able to finance itself and to even raise foreign currency. However, it must be noted that only those records of the most outstanding quality can be successful on the international market.

The pre-war German record companies, including Deutsche Grammophon, Electrola and Telefunken, quickly restored production in the post-war period and served an expanding market during the 1950s. However, none of these companies were directly involved with the revival of a record industry in East Germany. The GDR's record industry was instead founded primarily on the remains of a single small pre-war record label. Initially focussed on a restoration based on the 78rpm gramophone record pre-war format (78), the new company expanded steadily once nationalised and from this point quickly began to pursue distinctive commercial and cultural policies. This initial period of growth was disrupted by the technological shift in the international record industry from the 78 to the vinyl record. Deutsche Schallplatten, and the GDR audio industry generally, was ill-prepared for the arrival of the vinyl record and the record company was left to pursue survivalist policies as it attempted to retool its manufacturing base and build an entirely new supply chain. Despite the exodus of the pre-war record industry from Berlin and East German territories, collaborations and exchanges between the East and West German record industries were integral from an early stage. Deutsche Schallplatten depended on relationships with West German and Western European record companies and suppliers for hard currency and technical equipment, but its survival also

[1] Wiese, 'Vorschlag zur Bildung eines Internationalen Schallplattenkartells der sozialistischen Länder' (Deutsche Schallplatten, 19 November 1956), DR 1/257, BArch.

depended on securing essential materials from Eastern Europe. The establishment of these dynamic interactions between components of both the wider Western and Eastern European record industries secured Deutsche Schallplatten's viability, but only after extended periods where Deutsche Schallplatten's domestic production of records appeared unsustainable.

Deutsche Schallplatten came to rely heavily on the hard currency income it could generate by licensing classical music recordings for worldwide distribution, primarily, though not exclusively, through West German record companies. These earnings financed spending on Western recording and record manufacturing equipment, but these were disproportionately allocated to the enhancement of the quality of its classical music recordings and pressings. This was in harmony with general GDR cultural priorities but also acknowledged a global perception of where GDR musical value resided; during the 1950s and 1960s Deutsche Schallplatten's international licensing income was derived almost entirely from classical music recordings by established musical ensembles located in the GDR. Preserving this income led to a consistent policy of directing funds towards maintaining Deutsche Schallplatten's classical music recording standards. This had implications for allocations made for the recording of other musical genres, despite the dominance of non-classical forms of music in terms of domestic sales during the era of 78s. Deutsche Schallplatten's prioritisation of classical music is also evident in its record production figures. During the difficult transition to all-vinyl record production, a focus on classical music LPs skewed the genre distribution of records produced in the GDR during the 1960s significantly. The rapid escalation of vinyl record production during the late-1960s and 1970s subsequently re-established a more familiar distribution of genre in the company's output of records and popular music latterly achieved better recognition and prioritisation within Deutsche Schallplatten hierarchies.

Part 1: 78s, Vinyl Records and Material Narratives in the GDR Record Industry

Germany was an enthusiastic adopter of the record; its oldest record company, Deutsche Grammophon Gesellschaft was founded in 1898. Although Germany later made important technical contributions to the recording industry, the initial technical initiative for a record industry in Germany came from Britain and the US. The first record presses were imported from the US and the first matrices pressed in Germany were delivered by the Gramophone

Company in England.[2] By 1900 there were 45 presses operating from the label's manufacturing base in Hannover and in 1908 Germany's largest record company, Deutsche Grammophon, pressed 6.2 million records.[3] The First World War impacted production, in 1917 production bottomed out at 400,000 records.[4] Production levels at Deutsche Grammophon remained volatile during the following decades, ranging as high as nearly ten million in 1929 and as low as 1.4 million in 1937, before rebounding to 4.1 million in 1938.[5]

During the Second World War, the major German record labels were integrated into the nationalised manufacturing companies Siemens and AEG and German record companies continued to make new recordings throughout the Second World War.[6] However, records were only pressed in small quantities and these were prioritised for distribution in neutral or Nazi-occupied territories.[7] Record industry activities recommenced quickly after the end of the War. The major pre-war record companies received permission to re-commence production from the Western Allies and began the process of reactivating their pre-war manufacturing infrastructures. Deutsche Grammophon recovered rapidly and pressed 1.8 million records in 1948.[8] Deutsche Grammophon pressed records in both Berlin and Hannover for a period after the war but ceased its Berlin operation after the Berlin Blockade and consolidated production at its primary manufacturing site in Hannover.[9] Electrola's historic manufacturing base was located in the east of Berlin and it initially recommenced pressing records there.[10] In 1950, Electrola followed Deutsche Grammophon's example and moved its entire production and administrative base to Cologne.[11]

The restoration of a record industry within East German administrative structures was more fitful than what occurred in West Germany and had far less access to pre-war recording and record manufacturing infrastructures. In 1946, the actor Ernst Busch was able to secure permission from the Soviet military administration in Berlin to record, manufacture and release

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[2] Rémy Louis, *Deutsche Grammophon: State of the Art: Celebrating over a Century of Musical Experience* (New York: Rizzoli, 2010), 12.
[3] Louis, 23.
[4] Louis, *Deutsche Grammophon*.
[5] Louis, 29.
[6] Louis, 32.
[7] Horst Heinz Lange, *Die deutsche '78er' Discographie der Hot-Dance- und Jazz-Musik : 1903-1958*, 2., erw. Aufl. (Berlin: Colloquium Verlag, 1978), 40.
[8] Louis, *Deutsche Grammophon*, 41.
[9] Louis, 41.
[10] Lange, *Die deutsche '78er' Discographie der Hot-Dance- und Jazz-Musik*, 24.
[11] Lange, 24.

records, as well as song sheets and manuscripts. His company, Lied der Zeit, was the only official record company and record manufacturer operating in the Eastern Sector.[12] Busch's primary interest was in socialist worker's songs, but Lied der Zeit also released classical and popular music under the Eterna and Amiga sub-labels. These labels went on to become the two defining music labels of the GDR. Lied der Zeit was able to exploit small undestroyed remnants of the pre-war German record industry to restart record production. Its most important resource was the factory of the former Tempo label; Tempo Schallplatten GmbH was an independent popular music record label that continued pressing records at its Babelsberg factory until about 1944.[13] Tempo occupied the cheaper end of the music record market but it developed a good reputation for the technical and artistic quality of its recordings, which were mostly in-house productions apart from some American and Hungarian releases.[14] The Tempo label's heritage continued to directly contribute to Lied der Zeit's efforts as late as December 1949, when more than 600,000 record sleeves were uncovered from Tempo's old stores and re-entered into the manufacturing cycle.[15] In March 1947 Lied der Zeit secured a twenty-year lease agreement for Tempo's Babelsberg factory.[16] It received a one-off enterprise grant but was left to otherwise fund and organise the renovation of the factory itself.[17] Initially a private company, Lied der Zeit did receive additional government assistance in the form of loans from Rundfunk DDR between 1948 and 1951, prompted by solvency issues within the record company.[18] Lied der Zeit began pressing recordings of political songs, spoken word and classical and contemporary music in 1947.[19] Some of the records pressed were music recordings made by the Soviet-administrated and East German-run broadcaster Berliner Rundfunk and issued under a short-lived Radiophon label.[20] Production capacity was severely limited at this stage, probably only in the tens of thousands.[21] The public distribution of Lied der Zeit records was also restricted; many of the records that were pressed were given as state gifts to politicians and international guests rather than publicly sold.[22] Between 1947 and 1950 nearly 100,000 records were used

[12] 'Lied der Zeit: Finanzbericht 1950', 1950, 18, DR 135/1, BArch.
[13] Lange, *Die deutsche '78er' Discographie der Hot-Dance- und Jazz-Musik*, 41.
[14] Lange, 41.
[15] 'Lied der Zeit: Finanzbericht 1950', 16.
[16] 'Lied der Zeit: Finanzbericht 1950', Anlage II.
[17] 'Lied der Zeit: Finanzbericht 1950', Anlage II.
[18] 'Lied der Zeit: Finanzbericht 1950', Entwurf.
[19] 'Lied der Zeit: Finanzbericht 1950', 18.
[20] Lange, *Die deutsche '78er' Discographie der Hot-Dance- und Jazz-Musik*, 37.
[21] 'Lied der Zeit: Finanzbericht 1950', 16.
[22] 'Lied der Zeit: Finanzbericht 1950', 19.

for these purposes and this likely represents a substantial proportion of the total records pressed.[23]

By 1950 Lied der Zeit was beginning to operate like a conventional record company and records of expenditure on recording and record production are available from this period.[24] Busch received credit for re-establishing a stalled industry and the company managed some expansion during his stewardship; in February 1951, Lied der Zeit secured a lease for a second small record factory in Ehrenfriedensdorf. This factory was most significant for its ability to process the shellac required for pressing 78s.[25] At the same time, Busch was progressively side-lined during a period that saw much of GDR industry brought under central government control.[26] Lied der Zeit was nationalised as Deutsche Schallplatten in 1953 and Busch was removed.[27] Investment in recording and production began to climb and an expansion in documentation from this period onward indicates the company's recordkeeping became progressively more methodical from this date. Deutsche Schallplatten inherited the assets and facilities of Lied der Zeit: this included the administrative headquarters and recording studio at Taubenstraße and the two pressworks. Lied der Zeit was retained as the name of one of the organisation's sub-labels, but Busch's specialty of spoken-word political recordings and workers' songs became an ever-smaller proportion of the company's output. Busch's relationship with the new company was occasionally acrimonious but he continued to release records periodically.[28]

Along with its nationalisation, a significant event for the record company was the arrival of Harri Költzsch in 1954.[29] Just 27 when he took up the role of General Director, he remained in the position until 1988.[30] Költzsch was tasked with developing a recording and manufacturing capacity sufficient to enable Deutsche Schallplatten to become the GDR's

[23] 'Lied der Zeit: Finanzbericht 1950', 19.
[24] 'Lied der Zeit: Finanzbericht 1950', 11.
[25] 'Lied der Zeit: Finanzbericht 1950', Anlage II.
[26] Karl Schönewolf, 'Die Schnulze hat leider noch das Vorrecht', *Sonntag*, 25 August 1957, 34 edition, DR 135/51, BArch.
[27] 'Nachweis über die Überplanmäßige Selbstkostensenkung IV/1953' (Deutsche Schallplatten, 4 March 1954), DR135-2, BArch.
[28] 'Bericht über die Erfüllung des Aufnahmeplanes 1957 des VEB Deutsche Schallplatten' (VEB Deutsche Schallplatten, 26 February 1957), DR 1/257, BArch.
[29] Peter Wicke and Lothar Müller, *Rockmusik und Politik : Analysen, Interviews und Dokumente*, 1. Aufl. (Berlin: Ch. Links Verlag, 1996), 111.
[30] 'Neuer Direktor des VEB Deutsche Schallplatten', *Neues Deutschland*, 7 May 1988, 108 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19880507-0-7-116-0, ZEFYS.

primary source for recorded cultural and educational material.[31] There were substantial obstacles impeding his ability to achieve this kind of volume of production. Germany's major pre-war record companies, now all residing in West Germany, had recommenced with a large amount of dormant pressing capacity - this contrasted sharply with Deutsche Schallplatten's two small pressworks. In 1953 Deutsche Schallplatten was just beginning to produce records in serious volume, pressing about 1.6 million 78s that year - less than Deutsche Grammophon's total for 1948.[32] West German record companies remained the most important source of records for East German customers as Deutsche Schallplatten attempted to rapidly escalate its production levels. Költzsch's leadership was energetic and his actions during this period shaped the character of the GDR record industry in terms of manufacturing, recording policies, technical upgrades and foreign sales and supply deals. Költzsch's administrative efforts and the improved resources provided by nationalisation had immediate initial success; Költzsch oversaw a substantial jump in production in his first year with total output more than doubling to nearly three and a half million records.[33] Production in 1955 was similarly impressive, increasing by nearly two million records to 5,366,000 and establishing Költzsch's leadership.[34]

While Költzsch was able to oversee an increase in production, Deutsche Schallplatten's position within the unsettled GDR economy and its relationships with newly-formed GDR state organs and administrative structures created challenging conditions during the mid-1950s and beyond. Deutsche Schallplatten was highly sensitive to import restrictions and the GDR's administrative systems for commercial imports made procuring even mundane low-value items problematic. In December 1955 Deutsche Schallplatten placed an order to a Copenhagen firm through the relevant GDR organisation (Deutsche Handelszentrale Elektrotechnik und Feinmechanik-Optik (DHZ)) for twenty sapphire cutting elements used by record lathes to cut masters for pressing 78s.[35] After a delay of six months Költzsch resorted to asking the Minister for Culture, Alexander Abusch, to intercede with the order, as Deutsche Schallplatten was facing a complete shutdown of the production of new titles. The delivery of five sapphire elements was secured via airmail through direct communication with the Copenhagen firm, but

[31] Harri Költzsch, 'Plan der Einführung des technischen Fortschritts im VEB Deutsche Schallplatten zur Aufnahme der Schallplatten-Produktion 17cm/45 UpM.' (Deutsche Schallplatten, 29 November 1955), 1, DR 1/255, BArch.
[32] 'Abschlußbericht über den Verkauf 1953 von Schallplatten (Eigene Produktion), Schallplatten (Supraphon), Handesware' (Deutsche Schallplatten, 1953), DR135-2, BArch.
[33] 'Schallplattenproduktion (TStck.)' (VEB Deutsche Schallplatten, 22 October 1957), DR 1/257, BArch.
[34] 'Schallplattenproduktion (TStck.)'.
[35] Harri Költzsch, 'Harri Költzsch to Alexander Abusch #2', 18 June 1956, DR 1/255, BArch.

Figure 2.1: A 1957 satirical cartoon from the *Sonntag* newspaper. The cartoon articulates perennial frustrations with the slow pace of new releases by Deutsche Schallplatten during the 1950s.[36]

Deutsche Schallplatten's future relationship with that firm was endangered when their invoice was not honoured by DHZ.[37]

The re-organisations of GDR industry during the early 50s also contributed to the instability of Deutsche Schallplatten's record distribution network. There was a prolonged and complicated pattern of responsibility for record distribution being shifted between various organisations under different chains of authority, adding to disruption within the record supply chain. Until 1954, Deutsche Schallplatten directly supplied the GDR's record wholesaler organisation (Schallplatten-Großhandel), which was under the remit of the Ministry for Culture.[38] In 1955, rationalisation efforts folded the record wholesaler into the Großhandelskontor für Kulturwaren (GHK), under the responsibility of the Ministry of Trade and Supply.[39] The combination of ongoing production shortages and persistent distribution difficulties led to reputational damage for Deutsche Schallplatten among record-shop owners and record customers. A Dresden record seller claimed that customers' primary complaint was not the quality of records, but the limited catalogue, alleging that in 1955 only 25% of the sixty Tanzmusik ("dance music") titles promised by the record company's release schedule were actually received in stores.[40] Similar sentiments are expressed in the cartoon reproduced in Figure 2.1. Deutsche Schallplatten was itself dissatisfied with its relationship with record

[36] Schönewolf, 'Die Schnulze hat leider noch das Vorrecht'.
[37] Költzsch.
[38] 'Die Organisation des Schallplatten-Groß- und -Einzelhandels und seine Verbesserung' (Deutsche Schallplatten, 1958), 1, DR 1/258, BArch.
[39] 'Die Organisation des Schallplatten-Groß- und -Einzelhandels und seine Verbesserung', 1.
[40] E. Lämmel, 'Ein Wort zur Schallplatte', *Der Musikalienhandel*, 6 November 1955, DR 1/255, BArch.

sellers and wholesalers, particularly in the areas of staff training and knowledge and a reticence to promote sections of the record company's output:

> Hinzu tritt die völlig mangelhafte Fachkenntnis des Verkaufspersonals im Einzelhandel, und das Bestreben, möglichst große Umsätze ohne Einkaufsrisiko zu tätigen… nachweislich liegen Platten des ernsten Repertoires beim GHK am Lager, die in der Mehrzahl der Verkaufsstellen nicht geführt werden.[41]

> Add(ed) to the lack of expertise of sales personnel in the retail sector, and the desire to make the largest possible turnaround without purchasing risk… it has been shown that records of the serious repertoire are kept in storage at the GHK, the majority of which are not distributed to retail outlets.

The treatment of genre by Deutsche Scallplatten is one of the company's most interesting aspects and the distribution of genre during the company's years of peak 78 production provides a useful control for later developments, with Deutsche Schallplatten's classical Eterna label and its diverse popular music Amiga label serving as the focus for analysis. During the years of 78 production, Amiga heavily dominated output and was the main driver of Deutsche Schallplatten's first period of expansion. In 1955, Eterna records amounted to less than 50,000 units of the more than five million Deutsche Schallplatten records sold. This distribution is visualised in Figure 2.2 - all graphs in this chapter have been compiled using figures from various Deutsche Schallplatten administrative records, primarily annual reports (Jahresberichts, Geshäftsberichts etc.). Cultural-political factors in the GDR favoured classical music production and substantial fluctuations in the ratio of classical to popular music records produced were influenced by these policies. Periods of technical change - such as the transition to vinyl records - made parallel genre policies explicit in recording areas, but pricing was also used to influence the sales of classical and popular music from an early stage. In 1953, Eterna records were Deutsche Schallplatten's most expensive, at an average cost of 3.46 DM per record.[42] Unterhaltungsmusik ("light music") records released by Amiga averaged between 2.38 DM and 2.72 DM per record, respectively.[43] By 1959, under-pricing of records deemed

[41] 'Die Organisation des Schallplatten-Groß- und -Einzelhandels und seine Verbesserung', 2.
[42] 'Abschlußbericht über den Verkauf 1953 von Schallplatten'.
[43] 'Abschlußbericht über den Verkauf 1953 von Schallplatten'.

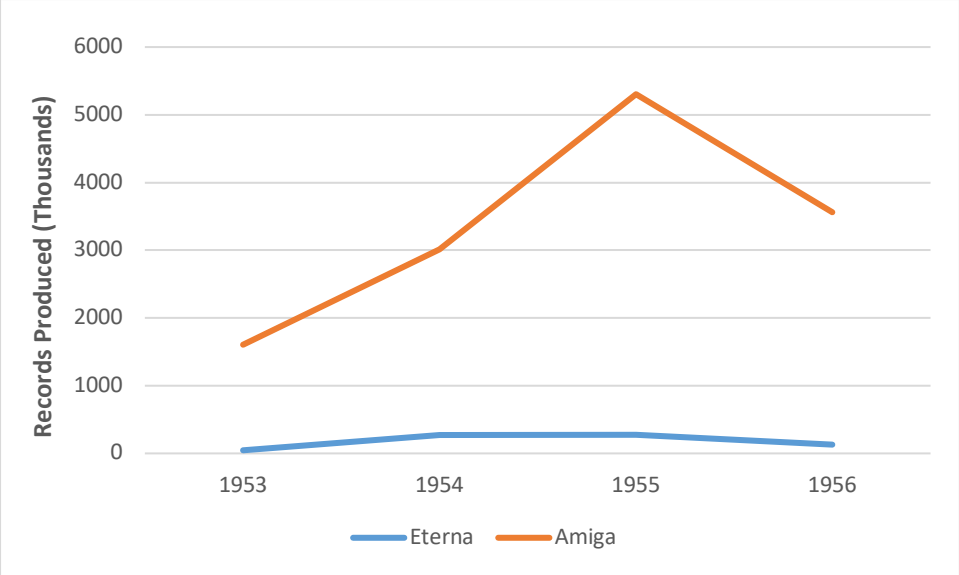

Figure 2.2: This graph shows production figures of 78s for Deutsche Schallplatten's two main music labels between 1953-1956. Apart from giving a sense of the overall level of production by the company, it depicts several important trends: the rapid escalation in production after the company's nationalisation, the decline of the 78 after 1955 and also the complete dominance of popular music record production during this initial period.

culturally or politically significant was standard policy for Deutsche Schallplatten.[44] This policy was applied preferentially to the Eterna label and spoken word and folk music records - Amiga releases progressively became the most expensive domestic records sold in the GDR.[45]

The restoration of the record industry across post-war Europe was founded on the pre-war format of the 78 rpm electrically-recorded gramophone record, made from varying combinations of shellac and mineral fillers. During the 1940s, poly-vinyl chloride-based micro-groove records emerged as a viable format. Although new methods meant there was potential to improve the audio quality of the 78, vinyl records had several attributes that made them better suited to the ambitions of the record industry.[46] Using vinyl allowed record manufacturing to be independent of the East Asian shellac supply chain, disrupted by both previous World Wars.[47] Vinyl records had lower surface noise, allowed a significantly longer playing duration due to their narrow grooves and slow revolving speed and they were also substantially more durable. These features made vinyl records a suitable vessel for continuing improvements in recording and playback standards and the playing length, in particular, offered

[44] 'Begründung zur Preisanordnung für Schallplatten Waren-Nr. 59173000' (Arbeitskreis für die Bildung von Festpreisen für Schallplatten, 1959), DR 1/258, BArch.
[45] Birgit Rauhut and Michael Rauhut, *Amiga: die Diskographie aller Rock- und Pop-Produktionen 1964 - 1990; Mit über 1500 teilweise farbigen Abbildungen* (Berlin: Schwarzkopf & Schwarzkopf, 1999), 8.
[46] Richard Osborne, *Vinyl: A History of the Analogue Record* (Burlington: Ashgate, 2012), 67.
[47] Osborne, 67.

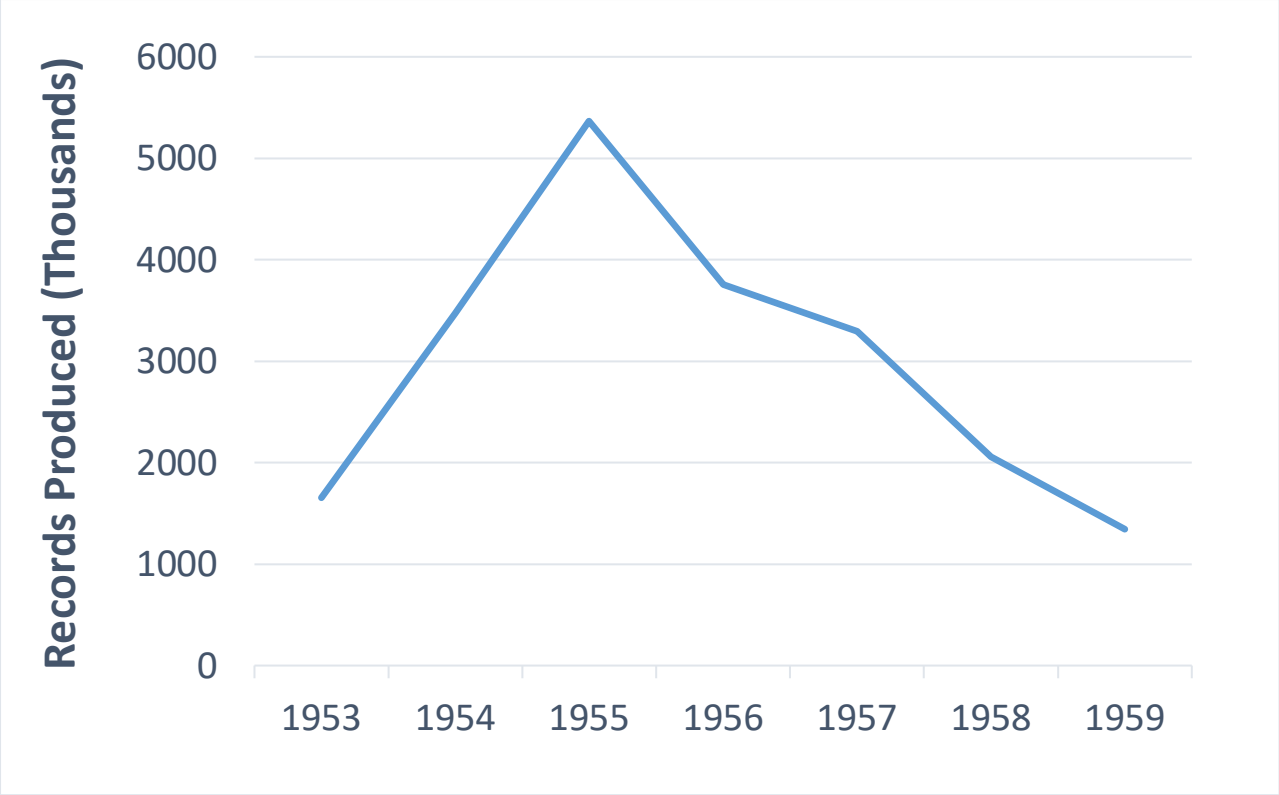

Figure 2.3: This graph of overall 78rpm record production by Deutsche Schallplatten between 1953-1959 makes explicit the rapid escalation in the production of 78s and their equally rapid (and permanent) decline after local factors precipitated an early end to the shellac-era in the GDR.

many new potentialities.[48] Vinyl had further attractions from a manufacturing point of view. The petrochemically derived materials for vinyl records could be controlled to a much more regularised standard of quality than shellac, a qualitatively volatile derivative of the natural excretions of the lac beetle. During the early 1950s vinyl records began to overturn the decades-long dominance of 78s in a booming US record market. In West Germany, Deutsche Grammophon pressed its first LPs in 1951 and pressed some 45s in 1953.[49] Although it took several more years for the market there to develop a demand for these new formats, Deutsche Grammophon and the West Germany record industry staged a comparatively controlled switchover. Deutsche Schallplatten was far less prepared. In 1953 Deutsche Schallplatten sold 12,660 LPs, but these were Supraphon label releases distributed on behalf of the Czechoslovak Socialist Republic (ČSSR) cultural publisher Artia Prague, which negotiated terms between Deutsche Schallplatten and the ČSSR record industry.[50]

[48] Osborne, 67.
[49] Louis, *Deutsche Grammophon*, 51 and 57.
[50] 'Abschlußbericht über den Verkauf 1953 von Schallplatten'.

Deutsche Schallplatten's ill-preparedness for the shift to vinyl records was exposed by sudden upheaval in the domestic gramophone record market in 1956. The previously cited Deutsche Schallplatten production figure of 5,366,000 records for 1955 is again of historical note. It represented the largest increase in production managed by Deutsche Schallplatten in its first decade, but it was also the peak of production of 78s in the GDR.[51] As vinyl records and record players became available in West Germany, GDR record sellers were unsettled and responded by sharply reducing their wholesale orders.[52] Consequently, the Ministry of Trade and Supply, which by then had responsibility for the wholesale of records, cut the year's total order by one and a quarter million records.[53] This was directly translated into Deutsche Schallplatten's end-of year figures for 1956, which slumped to 3,754,000.[54] This order cancellation was the starting point for the terminal decline of the production of 78s in the GDR, detailed in Figure 2.3, which by 1959 was less than one and a half million records. While the decline of the gramophone record was inevitable and well-signalled internationally, Költzsch attributed its abrupt character in the GDR to the actions of the Ministry of Trade and Supply.[55] Writing about West Germany, which had a more developed vinyl market, the discographer Horst Lange called 1958 ""Sterbejahr" der 78er Schellackplatten in Deutschland" (""year of death" of the shellac record in Germany").[56] This suggests that the fall in demand for 78s may not have been as precipitous as anticipated by record sellers in the GDR.

Lange's observation is corroborated by the transitional dynamic that occurred in the UK record manufacturing industry. Reported production figures show that the production of 78s there was stable and actually increased during this period; from 47 million to 51 million between 1956 and 1957.[57] This was in the context of a UK record industry that was already producing significant quantities of vinyl records; in 1957, the total production of LPs and 45s briefly coincided at 13 million apiece.[58] As in West Germany, 1958 was also the "Sterbejahr" of the 78 in the UK; production declined massively to 28 million that year and just 8 million in

[51] 'Schallplattenproduktion (TStck.)'.
[52] Harri Költzsch, Berger, and Heinz Neitzert, 'Deutsche Schallplatten to Hans Pischner', 14 September 1956, 1, DR 1/255, BArch.
[53] Költzsch, Berger, and Neitzert, 'Deutsche Schallplatten to Hans Pischner', 14 September 1956.
[54] 'Schallplattenproduktion (TStck.)'.
[55] 'Geschäftsbericht 1956' (Deutsche Schallplatten, 1956), 8, DR 1/256, BArch.
[56] Lange, *Die deutsche '78er' Discographie der Hot-Dance- und Jazz-Musik*.
[57] Tom Perchard, 'Technology, Listening and Historical Method: Placing Audio in the Post-War British Home', *Journal of the Royal Musical Association* 142, no. 2 (2017): 396, https://doi.org/10.1080/02690403.2017.1361176.
[58] Perchard, 396.

1959.[59] The mismanagement of the GDR's record supply chain and pre-emptive curtailment of the production of 78s is further confirmed by the actions of the Ministry of Trade and Supply itself, which belatedly increased its 1956 order due to a resurgence in demand towards the end of the year.[60] Deutsche Schallplatten's slow production turnaround times meant it was unable to respond with a compensatory increase in production for the Christmas market.[61] The production of 78s in the GDR never recovered, although they remained a significant proportion of the overall record market for a few more years and demand in Eastern European export markets remained steady, particularly in the Soviet Union. In 1959, 216,200 Deutsche Scallplatten 78s were exported to the Soviet Union; 16% of the record company's total production of 78s.[62] Nonetheless, the episode brought failures in the record supply chain and weaknesses in Deutsche Schallplatten's operational development into sharp focus, highlighting the precarity of the record company's position after a run of early successes. Record wholesale and distribution was reorganised several more times over the following years – in 1964 Deutsche Schallplatten began supplying record stores directly – and the record company came under increasing scrutiny regarding its efforts to begin vinyl record production.[63]

One of the most immediate impacts of the 1956 slump was how it influenced Deutsche Schallplatten's interpretations of developments within the industry; exemplified by a brief dispute between the record company and Rundfunk DDR in late 1956 and early 1957. The two GDR institutions had an intimate relationship in the recording field, but also in the area of distribution; Rundfunk DDR radio programmes were central to the promotion of Amiga releases in particular and the broadcast of the label's titles was regulated by contract.[64] Dysfunction within the GDR record supply chain also extended to broadcast distribution and there were some existing tensions due to misalignments between the promotion of Amiga releases on the airwaves and the belated delivery of physical records to shops, by which time they were considered "veraltet" ("stale").[65] On a visit to Electrola in Cologne during December

[59] Perchard, 396.
[60] Hagemann, 'Hagemann to Schneiderheinze', 15 November 1956, DR 1/255, BArch.
[61] Hagemann.
[62] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959' (Deutsche Schallplatten, 25 February 1960), 10, 15, DR 1/258, BArch.
[63] H.U., 'Frisch serviert vom Plattenteller', *Neues Deutschland*, 29 November 1964, 329 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19641129-0-4-159-0, ZEFYS; Folkmann, 'Schallplatten-Handel' (Deutsche Schallplatten, 23 December 1957), DR 1/258, BArch.
[64] 'Vertrag zwischen dem Staatlichen Rundfunkkomitee und dem VEB Deutsche Schallplatten', 1955, DR 1/255, BArch.
[65] Hagemann, 'Hagemann to Schneiderheinze', 15 November 1956, 2.

1956, Költzsch was told rumours of a deal signed between Rundfunk DDR and the record company Teldec that would favour the broadcasting of West German artists in the GDR.[66] Költzsch was alarmed by this report and made contact with Rundfunk DDR's legal department head, Friedrich Karl Kaul, by telephone before Christmas to demand a copy of the supposed agreement.[67] Költzsch followed up this call with a 4 January letter to Hans-Georg Uszkoreit, the head of the Department of Music at the Ministry of Culture, to castigate the deal and the impact it would have on the broadcast of Amiga releases.[68] Költzsch subsequently tracked the relative proportion of West German and GDR titles broadcast by Rundfunk DDR during the first week of January and alleged that a clear pattern of discrimination had already begun.[69]

The incident came to a head at a 23 January meeting attended by Rundfunk DDR, Deutsche Schallplatten and the Ministry for Culture.[70] Rundfunk DDR disputed Költzsch's account of the label distribution in its broadcasts and disawowed the existence of a deal with Teldec, although it affirmed its right to enter one.[71] Rundfunk DDR made some concessions to favouring Amiga releases, even though a later analysis of Rundfunk DDR's popular music broadcasting conducted by Uszkoreit confirmed this was already the case; in 1956 Amiga contributed four of the top five titles in the Rundfunk DDR Schlagerlotterie (Hit Parade).[72] The episode marked the start of new protectionist policies within Deutsche Schallplatten; Amiga had previously habitually released recordings by West German artists without limitation, but in 1957 it began to restrict the proportion of these releases to 50% and Rundfunk DDR later adopted a similar policy towards broadcasting West German titles.[73] Deutsche Schallplatten also began to actively entice GDR singers that had signed deals with Polydor to return to Amiga with improved conditions.[74] These measures contrast with the high degree of collaboration that was beginning to take place between Eterna and Deutsche Grammophon and other West German record companies and which became so integral to Deutsche Schallplatten's survival.

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[66] Költzsch, Harri, 'Harri Költzsch to Hans-Georg Uszkoreit', 4 January 1957, DR1-256, BArch.
[67] Költzsch, Harri, 'Harri Költzsch to Friedrich Karl Kaul', 8 January 1957, DR 1/256, BArch.
[68] Költzsch, Harri, 'Harri Költzsch to Hans-Georg Uszkoreit', 4 January 1957.
[69] Költzsch, Harri, 'Harri Költzsch to Friedrich Karl Kaul', 8 January 1957.
[70] Hans-Georg Uszkoreit, 'Aktennotiz: Schallplattenvertrag des Staatl. Runfunkkomitees mid der westdeutschen Schallplattenindustrie und eine dazu geführte Beschwerde des VEB Deutsche Schallplatten' (Hauptabteilung Musik, 25 January 1957), DR 1/256, BArch.
[71] Uszkoreit.
[72] Hans-Georg Uszkoreit, 'Zur Lage der Tanz- und Unterhaltungsmusik in der DDR: Schallplatten-Produktion 1956 (Amiga)' (Hauptabteilung Musik, 10 February 1957), DR1-257, BArch.
[73] 'Bericht über die Erfüllung des Aufnahmeplanes 1957 des VEB Deutsche Schallplatten', 2.
[74] 'Bericht über die Erfüllung des Aufnahmeplanes 1957 des VEB Deutsche Schallplatten', 2.

2.1.1 The Path to Vinyl Records

While Költzsch could point to external GDR actors for catalysing the decline of 78s, it was more difficult for him to deflect criticism that Deutsche Schallplatten's preparation for the shift to vinyl records was deficient. Serious efforts by record company to begin the domestic production of vinyl records only began in 1955 when it was directly tasked by the 25th plenum of the SED Central Committee with the production of a selection of 45s for the 1956 Leipzig Fair.[75] The Leipzig Fair records were to consist of ten Ernste Musik (classical music) records, ten Tanzmusik records, two Unterhaltungsmusik records and a single Volkmusik (folk music) record; potential artist and repertoire selections were not recorded. This selection of records was then to form the basis for a rapid transitioning from test-pressings to full-scale production by the end of 1956. This plan entailed a steady escalation of production through the four quarters of 1956: 5,000 records were to be pressed in the first quarter, climbing to 144,000 in the final quarter for a total of 300,000 45s in the first year of vinyl record production in the GDR.[76] This target had genre-based allocations: 80,000 classical records, 20,000 light music records and 200,000 dance music records.[77] None of these targets were reached. Just over 150,000 LPs and 45s were actually produced under the auspices of Deutsche Schallplatten in 1956, with the final genre allocation skewing from the planned ratios in favour of Eterna, with 78,000 LPs and 45s - more than 50% of the total.[78] Deutsche Schallplatten's production figures during this period do not distinguish between records pressed domestically and records pressed abroad under contract, but company correspondence from this period makes it clear that a very small proportion of these 45s and none of the LPs were pressed by Deutsche Schallplatten itself.[79] During the early years of Deutsche Schallplatten's vinyl record production the vast majority of records were pressed by the Gramofonové závody pressworks in Loděnice by arrangement with Artia Prague in the ČSSR.[80] The planned production totals for 1956 were still not reached, as Artia Prague ceased taking orders from Deutsche Schallplatten halfway through the year.[81] The outsourcing of record pressing became a frequent short-term solution

[75] Költzsch, 'Plan der Einführung des technischen Fortschritts im VEB Deutsche Schallplatten zur Aufnahme der Schallplatten-Produktion 17cm/45 UpM.'
[76] Költzsch, 2.
[77] Költzsch, 2.
[78] 'Schallplattenproduktion (TStck.)'.
[79] Költzsch, Berger, and Neitzert, 'Deutsche Schallplatten to Hans Pischner', 14 September 1956.
[80] Harri Költzsch, 'Notizen über unsere Zusammenarbeit mit ARTIA, Prag' (Deutsche Schallplatten, 26 January 1957), 2, DR 1/256, BArch.
[81] Költzsch, 2.

for Deutsche Schallplatten during the 1950s due to a shortage of presses and the absence of a domestic supply of vinyl compound. Deutsche Schallplatten's dependency on Artia Prague, in particular, for essential materials and services became a defining feature of the GDR record industry, but Költzsch made several attempts to escape it. The limitations of the GDR chemical industry meant he was only able to partially alter its character.

Preparing an independent vinyl record pressing capability for Deutsche Schallplatten required the acquisition of equipment for each production stage. An important initial step - and one of the most straightforward - was the purchase of a record lathe for cutting lacquer disc masters. A reliance on Scandinavian record pressing equipment began when a Lyric-brand record lathe from Denmark arrived without complication in December 1955.[82] Lacquer discs for creating pressing masters were one of the few key consumables for producing vinyl records that Deutsche Schallplatten never attempted to have produced in the GDR. They were readily available from several manufacturers in the UK, France and the US and they were one of only a few key items for which Deutsche Schallplatten's supply chain was never seriously threatened. Deutsche Schallplatten's first order in December 1955 was for 500 French Pyral-brand lacquer discs.[83] The majority of Deutsche Schallplatten's other vinyl production-related acquisitions during the 1950s were not as straightforward, particularly in regard to vinyl record presses and securing a regular supply of vinyl compound. Government directions to focus on domestic suppliers led Deutsche Schallplatten to take delivery of a record press manufactured by the GDR company Schulze in Köthen.[84] This press was rejected as unsuitable after an assessment at Babelsberg and Deutsche Schallplatten never attempted to purchase or develop a GDR-made record press again. However, this press may have been the source of Deutsche Schallplatten's limited test runs of 45s in 1956, which it repeatedly claimed to be of superior quality to those supplied by Artia Prague.[85] Procurement plans for vinyl record presses turned decisively towards foreign suppliers but were thwarted on several occasions. Two presses for 45s were ordered from the Copenhagen-based Johannessen & Lund in December 1955 with delivery initially anticipated for mid-1956, and which can be linked to the projected ramping up of production associated with the Leipzig Fair order, as previously described.[86] Although

[82] Költzsch, 'Plan der Einführung des technischen Fortschritts im VEB Deutsche Schallplatten zur Aufnahme der Schallplatten-Produktion 17cm/45 UpM.', 4.
[83] Költzsch, 7.
[84] 'Geschäftsbericht 1956', 8.
[85] Hagemann, 'Hagemann to Schneiderheinze', 15 November 1956.
[86] Költzsch, 'Harri Költzsch to Alexander Abusch #2', 18 June 1956.

there was regular direct contact between Deutsche Schallplatten and Johannessen & Lund, the order needed to be submitted through a GDR export intermediary and seven months later the order had still not been delivered.[87] Administrative complications related to securing the requisite hard currency funds further complicated the order and the presses did not arrive until February 1957. [88] Efforts in early 1957 to secure additional presses for 45s were again hampered, as administrative delays led to the presses being sold on by the supplier.[89] Similar patterns accompanied the import of LP vinyl presses.[90]

Even more than securing vinyl record presses, by far the most critical supply issue for Deutsche Schallplatten for nearly four decades was the basic record material itself: vinyl compound. Different proprietary formulations of vinyl have been used by various record companies since its introduction, and the material used for LPs and 45s can also vary. In the case of Deutsche Schallplatten, the surviving documentation does not make any distinction between supplies of vinyl compound for LPs or 45s. "Langspielmasse" (long-playing mass) or just "Masse" are the most consistent terms, but "Langspiel" in this context was primarily used to distinguish vinyl compound from "Normalmasse" or "Schellackgranulat" (shellac). In the early years of vinyl record production, strategic plans consistently incorporated the assumption that the GDR chemical industry would eventually produce enough vinyl compound to cover the entirety of domestic record production. One of the largest chemical factories in the GDR, the VEB Leuna-Werke *"Walter Ulbricht"*, was tasked in 1955 with developing the processes and production line necessary to supply the initial production of 45s at Babelsberg.[91] The Leuna factory was one of a cluster of GDR chemical facilities that were key in cooperative development schemes for the Eastern Bloc chemical industry and large quantities of capital were expended on developing their manufacturing capabilities.[92] It was originally expected that the Leuna factory would be ready to begin a vinyl compound supply by mid-1956 and some test pressings using material from Leuna were made at Babelsberg.[93] However, beyond this small test-order the Leuna factory did not contribute any practical proportion of Deutsche Schallplatten's production needs that year. In a reactive attempt to meet the 1956 production

[87] Költzsch.
[88] 'Geschäftsbericht 1956', 8; Harri Költzsch, 'Harri Költzsch to Professor Max Butting', 3 April 1957, DR 1/257, BArch.
[89] Költzsch, 'Harri Költzsch to Professor Max Butting', 3 April 1957.
[90] 'Geschäftsbericht 1956', 8; Költzsch, 'Harri Költzsch to Professor Max Butting', 3 April 1957.
[91] Költzsch, 'Harri Költzsch to Alexander Abusch #2', 18 June 1956.
[92] Eli Rubin, *Synthetic Socialism: Plastics & Dictatorship in the German Democratic Republic* (Chapel Hill: University of North Carolina Press, 2008), 72.
[93] Költzsch, 'Harri Költzsch to Alexander Abusch #2', 18 June 1956.

goals, Költzsch used contingency funds to make several attempts at directly importing thirty tonnes of vinyl compound from West Germany, Poland and the ČSSR.[94] By November, these efforts resulted in a delivery of just two tonnes from West Germany.[95] This was used for further test runs of 45s, but failed to provide a basis for regularised production. The infrastructural steps taken by Deutsche Schallplatten in 1956 to secure domestic vinyl record production did not cohere in 1957 and securing technical equipment and raw materials remained a complicated and uncertain task of cross-national negotiation. In June 1957, Költzsch still expected the Leuna factory to be able to provide the required quantities of vinyl compound by the following year.[96] By December of the same year, this plan had evaporated, the Leuna factory had given up any attempt to produce vinyl for record industry purposes and Deutsche Schallplatten was left entirely dependent on its own ability to secure an alternative supply.[97] Leuna's shortcomings in assisting Deutsche Schallplatten's vinyl record production efforts were indicative of wider deficits in the GDR chemical industry, but they also came close to prompting the end of record production in the GDR.[98]

Even amidst the context of significant reorganisation within larger sections of the GDR economy, Deutsche Schallplatten's travails during 1956 and 1957 did not escape notice from central government. The volatility of the gramophone market, combined with the failures in vinyl production, prompted a major intervention in Deutsche Schallplatten's strategic planning. In June 1957, the Ministry of Culture and Deutsche Buchexport (the GDR's publishing and intellectual copyright export organisation) negotiated a preliminary agreement with Artia Prague to produce the GDR's entire supply of vinyl records indefinitely, without the involvement or agreement of Deutsche Schallplatten.[99] The terms of this proposal were intended to facilitate a large increase in vinyl record supply: from 1.5 million records in 1959

[94] Harri Költzsch, 'Harri Költzsch to Alexander Abusch #1', 18 June 1956, DR 1/255, BArch; Költzsch, Harri, 'Bericht über die durchgeführte Reise in die Volksrepubliken Ungarn und Polen' (Deutsche Schallplatten, 19 October 1956), 8, DR 1/256, BArch.
[95] Hagemann, 'Hagemann to Schneiderheinze', 15 November 1956.
[96] Költzsch, Harri, 'Harri Költzsch to Hans Pischner', 27 June 1957, DR 1/257, BArch.
[97] Harri Költzsch, Heinz Neitzert, and Herbert Stengel, 'Revisionsprotokoll: Über die durchgeführte dokumentarische Revision für den Zeitraum vom 1.1.1957 - 30.9.1957 einschließlich Bilanz zum 31. Dezember 1956 lt. Verordnung über die Finanzrevision vom 6.11.1952.' (Ministry for Culture, Central Accounting Department, 4 December 1957), 4, DR 1/257, BArch.
[98] Raymond G. Stokes, *Constructing Socialism: Technology and Change in East Germany 1945-1990*, Johns Hopkins Studies in the History of Technology (Baltimore; London: Johns Hopkins University Press, 2000), 92.
[99] 'Entwurf über die Zusammenarbeit auf dem Gebiete der Schallplattenindustrie der DDR und der CSR unter besserer Ausnützung der bestehenden und geplanten Kapazität' (Ministry of Culture, Deutsche Buchexport, Artia Prague, 7 June 1957), DR 1/257, BArch.

to 4 million records in 1960 and annual increases of 10% thereafter.[100] The plan gave Artia Prague total responsibility for the entire manufacturing process; Deutsche Schallplatten would supply edited tape recordings and Artia Prague would cut the masters, press the records and deliver them pre-packaged.[101] One of the plan's few concessions to Deutsche Schallplatten's progress in developing its own vinyl record production capacity was its then ongoing efforts to source vinyl compound from within the GDR. The proposed agreement suggested that both Deutsche Schallplatten and Artia Prague should continue to develop their sources of vinyl compound and whichever country could produce the superior grade of vinyl would go on to supply the entire order for both countries.[102]

Deutsche Schallplatten appeared to have some intimation of the Ministry for Culture's intention to cease vinyl record production in the GDR; the record company was internally formulating counter-arguments and developing reactive plans to bolster the domestic recording industry as early as February 1957.[103] One of the components of this early defensive formulation was an appeal to the incongruence of a country with some of the world's most famous musical ensembles being technically unable to produce its own records.[104] After receiving the Ministry of Culture's specific proposals, Költzsch responded in a June 1957 letter to Hans Pischner, then Deputy Minister for Culture and former head of music.[105] Költzsch was strongly set against the out-sourcing of vinyl record production and his tactics to neutralise this proposal can be placed in two broad categories: emphasising how quickly vinyl record production in the GDR could be escalated and disparaging Artia Prague's claims about its capabilities. Unable to point to any concrete results from his efforts to press vinyl records at Babelsberg, Költzsch nonetheless argued that production of 45s could be quickly normalised using the two presses then available at Babelsberg.[106] The production of LPs could also soon be accommodated at Babelsberg by the deprioritisation of 78s and the impending arrival of LP

[100] 'Entwurf über die Zusammenarbeit auf dem Gebiete der Schallplattenindustrie der DDR und der CSR unter besserer Ausnützung der bestehenden und geplanten Kapazität'.
[101] 'Entwurf über die Zusammenarbeit auf dem Gebiete der Schallplattenindustrie der DDR und der CSR unter besserer Ausnützung der bestehenden und geplanten Kapazität'.
[102] 'Entwurf über die Zusammenarbeit auf dem Gebiete der Schallplattenindustrie der DDR und der CSR unter besserer Ausnützung der bestehenden und geplanten Kapazität'.
[103] 'Argumentation für den Aufbau einer eigenen modernen Langspielplattenproduktion in der Deutschen Demokratischen Republik' (Deutsche Schallplatten, 15 February 1957), DR 1/257, BArch.
[104] 'Argumentation für den Aufbau einer eigenen modernen Langspielplattenproduktion in der Deutschen Demokratischen Republik'.
[105] Költzsch, Harri, 'Harri Költzsch to Hans Pischner', 27 June 1957.
[106] Költzsch, Harri.

presses.[107] Költzsch targeted several aspects of Artia Prague's track record as justification for maintaining domestic production. Artia Prague had demonstrably expanded the scale of its vinyl record production at an impressive rate and it was the largest Eastern Bloc producer of vinyl compound apart from the Soviet Union, but Költzsch queried its ability to meet the targets suggested by the Ministry of Culture's proposal on several grounds. Staff at Babelsberg could testify towards a historical pattern of missed deliveries of shellac material for 78s prior to the beginning of vinyl record production.[108] There were also historical quality control issues. In 1955 Deutsche Schallplatten rejected nearly 23 tonnes (30% of the total delivery) of Artia Prague-supplied shellac on quality-control grounds.[109] In 1956, in the region of 140,000 Deutsche Schallplatten 78s were returned by distributors and subsequently destroyed due to a variety of technical defects.[110] Deutsche Schallplatten attributed these defects to problems with the Artia Prague shellac supply.[111] Unfulfilled deliveries also became an established pattern when Artia Prague began to supply Deutsche Schallplatten with completed vinyl records under contract. In 1955, Artia Prague's pressed 52,000 LPs for Deutsche Schallplatten, but this was nearly 30% less than the contracted order. [112] The 1956 shortfall of LPs and 45s previously discussed was particularly damaging for Deutsche Schallplatten's reputation, as it had undertaken to supply Deutsche Buchexport with 90,000 vinyl records for export.[113] Quality concerns also accompanied Artia Prague's vinyl record deliveries, Költzsch alleged that substantial quantities of these records were destroyed due to quality concerns.[114] Költzsch regularly contrasted Artia Prague's vinyl record short-comings with the purportedly better quality of the few test-pressings Deutsche Schallplatten did make in 1956, using vinyl compound imported from West Germany.[115] An extra element of distrust around the involvement of imported vinyl compound was introduced after a visit Költzsch made to the Nobel vinyl factory in West Germany in January 1957. Költzsch reported that he was told that Artia Prague was importing vinyl compound from West Germany, in addition to manufacturing

[107] Költzsch, Harri.
[108] Harri Költzsch, 'Harri Költzsch to Raschke', 2 December 1955, DR 1/255, BArch; 'Ökonomische Jahresanalyse 1956' (Deutsche Schallplatten, 1957), 7, DR 135/51, BArch.
[109] Költzsch, 'Harri Költzsch to Raschke', 2 December 1955.
[110] Max Butting, 'Vernichtung von Schallplatten durch den VEB-Deutsche Sehallplatten im Jahre 1956', 1957, DR 1/257, BArch.
[111] Butting.
[112] 'Argumentation für den Aufbau einer eigenen modernen Langspielplattenproduktion in der Deutschen Demokratischen Republik'; 'Schallplattenproduktion (TStck.)'.
[113] 'Schallplattenproduktion (TStck.)'; Költzsch, Berger, and Neitzert, 'Deutsche Schallplatten to Hans Pischner', 14 September 1956.
[114] Költzsch, 'Notizen über unsere Zusammenarbeit mit ARTIA, Prag', 1.
[115] Hagemann, 'Hagemann to Schneiderheinze', 15 November 1956.

its own.[116] In light of his experience of the quality disparity between the vinyl compound supplied from Eastern and Western European sources, Költzsch interpreted this to mean that Artia Prague was pursuing a dual policy in regard to its contracted vinyl production: the pressworks in Loděnice was using superior West German vinyl for the orders it was taking from Western European customers and reserving the inferior vinyl for customers including Deutsche Schallplatten.[117]

Költzsch also cast aspersions about Artia Prague's international reputation. He claimed that Western record companies had previously shared record masters with Deutsche Schallplatten on the condition that they wouldn't be pressed at Loděnice.[118] This was allegedly due to their bad technical reputation and a suspicion that the records they pressed were also finding their way to the black market.[119] Költzsch may have been playing on contemporary fears within the recording industry; court cases were taken in New York against US labels pressing German war-time tape recordings without paying copyright fees.[120] Overall, Költzsch argued that Deutsche Schallplatten would soon be in a position to meet the Ministry for Culture's production targets using predominantly domestic means.[121] However, even in Költzsch's best-case scenarios for GDR-based production and despite his dismantling of Artia Prague's technical standards and capabilities, cooperation with Artia Prague was still a prerequisite for all his plans. In the short-term, Deutsche Schallplatten needed Artia Prague to supply shellac for 78s and vinyl compound, as well as pressed LPs. Despite the extent of this dependency, Költzsch was adamant that the degree to which Deutsche Schallplatten relied upon Artia Prague would steadily decline and that the company should be kept aware of its status as a stop-gap solution.[122] His argument justified the short-term subcontracting of LP production and import of vinyl compound as the most pragmatic means of serving the GDR's immediate expectations, while always aiming at a fully independent industrial base. Költzsch pressed the Ministry for Culture for a quick response and, despite some of the implicit

[116] Költzsch, 'Notizen über unsere Zusammenarbeit mit ARTIA, Prag'.
[117] Költzsch, 1.
[118] 'Argumentation für den Aufbau einer eigenen modernen Langspielplattenproduktion in der Deutschen Demokratischen Republik'.
[119] 'Argumentation für den Aufbau einer eigenen modernen Langspielplattenproduktion in der Deutschen Demokratischen Republik'.
[120] 'Indie Labels Wax Hot Tapes From East Zone', *Variety (Archive: 1905-2000); Los Angeles*, 24 March 1954.
[121] Költzsch, Harri, 'Harri Költzsch to Hans Pischner', 27 June 1957.
[122] Költzsch, Harri.

contradictions present in his strategic plan, the complete outsourcing of vinyl record production to the ČSSR did not occur.[123]

Deutsche Schallplatten's large-scale strategic response to the problem years of 1956 and 1957 and the Ministry of Culture's intervention was contained in a Seven-Year Plan enacted from 1958. This expanded on Költzsch's reactive proposals and previously developed strategic plans for consolidating vinyl record production with a concurrent controlled decline in the production of 78s.[124] This was characterised within the company by the shutting down of the Ehrenfriedersdorf factory in June 1958 and the consolidation of all production expansion and modernisation efforts at Babelsberg.[125] The Seven-Year Plan laid out steady annual increases across many categories: the amount of music recorded by the label was projected to nearly double between 1960 and 1965 and the amount of music acquired through tape exchanges was to increase by 150% over the same period.[126] Pressing of 45s was projected to rise by at least 300,000 records each year.[127] Expectations for LPs were more modest. Domestic LP production would reach 400,000 records a year by 1962, but was not projected to expand beyond that during the timescale of the Seven-Year Plan.[128] Overall LP production expansion instead remained reliant on sub-contracts with Artia Prague, which were expected to reach 800,000 records a year by 1965. By 1965 the target for total records produced, including those sub-contracted through foreign contracts, was 5,200,000.[129] This was still a hundred thousand fewer records than the number of 78s the GDR had produced by itself in 1955, although this is not an entirely equivalent comparison. While the production figures of Deutsche Schallplatten's Seven-Year Plan were less ambitious than the 1957 proposal of the Ministry for Culture, it provided a framework for maintaining steady improvement within an industry that was still undergoing significant change. Költzsch gave Artia Prague little credit for its involvement in the GDR record industry, but this commercial relationship was critical to the introduction of Deutsche Schallplatten LPs and it remained essential to Deutsche Schallplatten's own pressing of vinyl records throughout the GDR-era.

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[123] Költzsch, Harri.
[124] Költzsch, Neitzert, and Stengel, 'Über die durchgeführte dokumentarische Revision für den Zeitraum vom 1.1.1957 - 30.9.1957', 2–3.
[125] Költzsch, Berger, and Neitzert, 'Deutsche Schallplatten to Hans Pischner', 14 September 1956.
[126] 'Die Entwicklung der Schallplattenindustrie der DDR im 7-Jahrplan #1' (Deutsche Schallplatten, 1957), DR 1/263, BArch.
[127] 'Die Entwicklung der Schallplattenindustrie der DDR im 7-Jahrplan #1'.
[128] 'Die Entwicklung der Schallplattenindustrie der DDR im 7-Jahrplan #1'.
[129] 'Die Entwicklung der Schallplattenindustrie der DDR im 7-Jahrplan #1'.

2.1.2 Vinyl Record Production at Babelsberg

Deutsche Schallplatten began to make more impactful infrastructural improvements to its vinyl record production during the late 1950s; a graph of the company's total record production during this period is reproduced in Figure 2.4. In 1959 more than 1.5 million Deutsche Schallplatten 45s were pressed, the first time the number of vinyl records it produced exceeded 78s, which stood at 1.34 million.[130] While Babelsberg and Artia Prague production is not separated in these figures, the vastly increased quantities of vinyl compound imported by Deutsche Schallplatten in 1959, in excess of 75 tonnes, indicates that the majority of these records were domestically produced.[131] More than 300,000 Deutsche Schallplatten LPs were also produced in 1959; these figures incorporate the first domestically pressed runs of LP records after the arrival and installation of two LP presses that year.[132] 1959 also had positive features for Deutsche Schallplatten's material supply chain. Finding a domestic supplier for vinyl compound was retained as a component of the Seven-Year Plan, despite the dismal outcome of the Leuna factory collaboration in 1956. Apart from ideals of GDR self-sufficiency, these efforts were galvanised by the insecurity of foreign supplies. In 1959 Babelsberg ordered 75 tonnes of vinyl compound from Artia Prague and West German suppliers but was undersupplied by 30 tonnes.[133] The second attempt at producing vinyl compound within the GDR involved a new collaborator, Elektrochemisches Kombinat Bitterfeld (Bitterfeld), and 1959 was the first year GDR-produced vinyl made a significant contribution to record production. The start of regular vinyl compound deliveries from Bitterfeld to Babelsberg in April of about 500 kg of vinyl compound a week was a source of relief to workers there and helped make up for a 40% overall shortfall of import projections for that year.[134]

[130] 'Ökonomische Jahresanalyse 1959' (Deutsche Schallplatten, 1960), 10, DR 135/51, BArch.
[131] 'Ökonomische Jahresanalyse 1959', 11.
[132] 'Ökonomische Jahresanalyse 1959', 10, 12.
[133] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959', 11.
[134] Költzsch, Harri, 11.

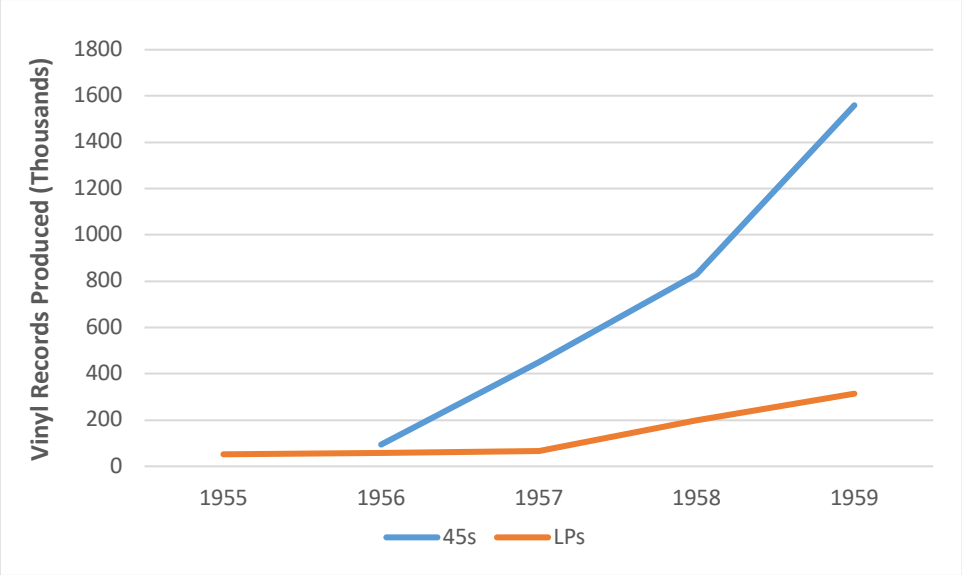

Figure 2.4: Figures for the total production of vinyl records by Deutsche Schallpatten between 1955 and 1959, likely including records pressed under license outside of the GDR. The figures reflect the company's prioritisation of the production of 45s over LPs.

In 1959 and 1960, Deutsche Schallplatten's vinyl record production chain remained a complicated criss-cross of East-West commercial collaborations. Edited studio recordings were sent to West Germany on tape for cutting to lacquer and the electro-plating of masters and stampers.[135] Some of these were then sent east to Loděnice, where they were pressed and returned for distribution in the GDR, while others were sent directly to Babelsberg. In 1960, initial misgivings held about the quality of Bitterfeld's deliveries of vinyl compound were gradually confirmed. The trial-batches of Bitterfeld vinyl were rough on the record presses and there were also aesthetic concerns due to the colour of the finished records, which had a bluish tinge unlike the familiar jet-black.[136] These issues were initially deemed acceptable quality-control problems associated with the starting of a new production line and quality-wise the records were judged sufficient in the short-term for certain sections of the company's repertoire.[137] This equated to using the Bitterfeld vinyl for pressing Amiga records only, in line with broad policies that prioritised the preservation of technical standards for Eterna records. During the same period, Deutsche Schallplatten was maintaining a policy of using imported recording tape for Eterna recordings, while continuing the use of lower-grade domestic-manufactured Agfa-Wolfen tape for Amiga recording sessions.[138]

[135] 'Die Entwicklung der Schallplattenindustrie die DDR im 7-Jahrplan' (VEB Deutsche Schallplatten, 1960), DR 1/263, BArch.
[136] 'Niederschrift über die Sitzung der sozialistischen Arbeitsgruppe zur Entwicklung einer Schallplatten-Langspielmasse am 3.6.1959 um 10:00 Uhr in Bitterfeld', 4 June 1959, 3, DR 1/261, BArch.
[137] 'Ökonomische Jahresanalyse 1959', 11.
[138] 'Ökonomische Jahresanalyse 1959', 11.

Meetings held between Deutsche Schallplatten, the Ministry for Culture and representatives of Bitterfeld and other GDR chemical firms in April 1959 to resolve questions related to quality and delivery concerns revealed rapidly escalating discrepancies between the various parties' expectations.[139] Deutsche Schallplatten was seeking a rapid increases in line with the progressive production projections of their Seven-Year Plan: 115 tons for 1960 and 270 tonnes by 1963.[140] Bitterfeld could offer no increase in production during 1961 due to its own supply chain problems, but was seeking huge increases beyond that in order to maintain the viability of the production line: 500 tonnes in 1962 and 2000 tonnes in 1965.[141] Any discussion of funnelling Bitterfeld's excess production towards export and supplying foreign record companies was not noted in the meeting's record. A further meeting of the same work group in June discussed progress in meeting Babelsberg's short-term supply requirements; Bitterfeld was limited to a theoretical maximum of 55 tonnes for 1960, leaving Deutsche Schallplatten to again seek vinyl compound supplies from abroad.[142] Bitterfeld actually over-fulfilled its order of vinyl compound for 1960 and delivered 60 tonnes by September.[143] Babelsberg continued to segregate the Bitterfeld vinyl for use with Amiga records.[144] After September deliveries from Bitterfeld began to dwindle and by November they were less than a tonne for the entire month.[145] Around the same time that Bitterfeld's deliveries began to tail off, Költzsch learned from documents at the Ministry for Culture that Buna Werke Schkopau, Bitterfeld's most important supplier, had suggested that Deutsche Schallplatten would be better off importing vinyl compound.[146] Deutsche Schallplatten's unfruitful interactions with the domestic chemical industry foreshadowed larger failures of scale and quality that impacted wider sections of GDR industry during the 1960s.[147] The relationship with Bitterfeld fell away and the following year was characterised by the start of a pivot towards a near-total dependency on Artia Prague for vinyl compound deliveries, which remained stable for three decades.

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[139] 'Niederschrift über die Sitzung der sozialistischen Arbeitsgruppe zur Entwicklung einer Schallplatten-Langspielmasse am 7.4.1959 um 10:00 Uhr in Bitterfeld', 10 April 1959, DR 1/261, BArch.
[140] 'Niederschrift über die Sitzung der sozialistischen Arbeitsgruppe zur Entwicklung einer Schallplatten-Langspielmasse am 7.4.1959 um 10:00 Uhr in Bitterfeld', 2.
[141] 'Niederschrift über die Sitzung der sozialistischen Arbeitsgruppe zur Entwicklung einer Schallplatten-Langspielmasse am 7.4.1959 um 10:00 Uhr in Bitterfeld', 2.
[142] 'Niederschrift über die Sitzung der sozialistischen Arbeitsgruppe zur Entwicklung einer Schallplatten-Langspielmasse am 3.6.1959 um 10:00 Uhr in Bitterfeld'.
[143] Reppe, 'Rentabilitätsbericht: Berichtszeitraum: November 1960' (Deutsche Schallplatten, 16 December 1960), 60, DR 1/263, BArch.
[144] Költzsch, Harri, 'Harri Költzsch to Hans Pischner', 8 September 1960, DR 1/260, BArch.
[145] Reppe, 'Rentabilitätsbericht: Berichtszeitraum: November 1960', 3.
[146] Költzsch, Harri, 'Harri Költzsch to Hans Pischner', 8 September 1960.
[147] Rubin, *Synthetic Socialism*, 194.

In 1961 Deutsche Schallplatten's total order of vinyl compound was 170 tonnes, with 120 tonnes on order from Artia Prague and 50 tonnes from West Germany.[148] 84 tonnes and 30 tonnes were received in the first half of the year from these respective suppliers, but deliveries then stalled, leading to an emergency order of 58 tonnes from England to cover production until the end of the year.[149] Vinyl compound deliveries from Western Europe in these quantities were unusual and Artia Prague's overall contribution to Deutsche Schallplatten's production requirements increased steadily over the following years, although quality problems with vinyl compound deliveries persisted. In 1962 Deutsche Schallplatten pressed its first commercial run of stereo records using imported Artia Prague vinyl compound; many of these were faulty and were returned by wholesalers.[150] Deutsche Schallplatten attributed this to a deficiency with the material as previous trial runs of stereo records, using West German vinyl, had given good results.[151] These problems aside, 1962 was an important year for Deutsche Schallplatten's production of LPs; it more than doubled the previous year's total to 624,000, exceeding targets by 10%.[152] In 1963 the quantities of vinyl compound supplied by Artia Prague continued to increase, although quality-control concerns were particularly acute in relation to the production of stereo records.[153] In September 1963 Deutsche Schallplatten applied to the GDR's import agency to request a delivery of 5 tons of vinyl compound from the West German Kalkhoff supplier to allow it to re-run stereo trials.[154] Deutsche Schallplatten's technical reports consistently favoured West German vinyl compound suppliers but the company's records do not give a clear indication as to why they did not pursue regular supplies as a definitive solution, although price and fluctuating import restrictions are likely factors.

The continued uncertainty surrounding vinyl deliveries and their quality during the late 1950s and early 1960s prompted changes of practice at the pressing plant in Babelsberg. In 1959 Költzsch credited the workers there for their role in the turnaround of Deutsche Schallplatten's production figures that year:

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[148] 'Economisches Jahresbericht 1961' (Deutsche Schallplatten, 1962), 11, DR 135/51, BArch.
[149] 'Economisches Jahresbericht 1961', 11.
[150] 'Economisches Jahresbericht 1963' (Deutsche Schallplatten, n.d.), 16, DR 135/51, BArch.
[151] 'Economisches Jahresbericht 1963', 16.
[152] 'Economisches Jahresbericht 1963', 17.
[153] 'Analyse der Planerfüllung im 1. Halbjahr 1963' (Deutsche Schallplatten, 25 July 1963), 9, DR 1/266, BArch.
[154] 'Analyse der Planerfüllung im 1. Halbjahr 1963', 9.

> Dieser Stand in der Prokopfleistung der Producktionsarbeiter konnte nur durch den energischen Kampf gegen die beeinflußbaren Ausfallstunden erreicht werden.[155]
>
> This level in the per capita performance of the production workers could only be achieved by an energetic fight against the influence of lost hours.

Babelsberg began hedging materials as soon as it had its first surplus supply of vinyl compound, beginning with 18 tonnes of unused vinyl at the end of 1963.[156] In 1964, informal economising strategies at Babelsberg began to be systematised. This was initiated by a detailed analysis of production procedures at Babelsberg conducted by the economics department of the Ministry for Culture in July 1964.[157] This analysis was wide-ranging and supportive of many of Deutsche Schallplatten's arguments for capital investment, but it was also critical of aspects of the company's production processes.[158] It was particularly focussed on electroplating and record pressing practices at Babelsberg, stating:

> Die Materialverbrauchsnormen für die Schallplattenproduktion sind nicht eingehalten.[159]
>
> The material consumption standards for record production are not being observed.

Babelsberg's existing economising strategies were encouraged, particularly attempts to save vinyl by reducing the weight of records. Engineers managed this firstly by changing the default shape of the record from a tapered edge at the rim to a flatter beaded edge (Wulstrand), which had previously been common with shellac records. 12" LPs pressed at Babelsberg in the early 1960s averaged around 210 grams in weight, the new approach reduced this to around 180 grams.[160] A trial run of 300,000 records using the new shape was calculated to have spared ten tonnes of vinyl material in 1963.[161] This was another example of a production process that was

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[155] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959', 12.
[156] 'Analyse der Planerfüllung im 1. Halbjahr 1963', 7.
[157] Dr. Rackwitz et al., 'Bericht über eine untersuchung beim VEB Deutsche Schallplatten in der Zeit vom 11.6. bis 24.6.1964' (Ministry for Culture, Economics Department, 10 July 1964), DR 1/266, BArch.
[158] "Die Material-Verbrauchsnormen für die Schallplattenproduktion sind nicht eingehalten", Dr. Rackwitz et al., 12.
[159] Dr. Rackwitz et al., 12.
[160] Dr. Rackwitz et al., 13.
[161] Dr. Rackwitz et al., 12.

applied predominantly to Amiga records.[162] However, the Ministry for Culture economists suggested additional savings were possible and the pursuit of ever-lighter records would remain a feature of the production of records at Babelsberg into the 1970s and reductions in weight continued over the following years.[163]

Inefficiencies were also identified in Babelsberg's electroplating processes. Initially, Babelsberg's electroplating division was regarded internally as one of its most dependable technical processes and Deutsche Schallplatten had reasonable success using domestic sources of nickel, although import nickel was also a component.[164] The economising report sought improvement in the electroplating standards at Babelsberg in the hopes of further cost-savings. In theory, a nickel record stamper for 45s was capable of pressing 5,000 records. Deutsche Schallplatten's own target was 2,000 pressings, but reports indicated they were achieving less than 1,000 pressings per stamper.[165] Steady improvements in the electro-plating processes were carried out over the following decade. Between 1969 and 1970 Babelsberg was able to improve the durability of nickel stampers by an average of 200 pressings per stamper.[166] Aside from these economising efforts, the factory at Babelsberg was also steadily modernising. The original steam plant, now decades old, began to receive attention to allow it to supply adequate pressure to the growing number of presses and to provide heat to help improve other processes. It had taken time for heat-management to be recognised as an important part of the pressing process; historically, production had sometimes been stopped during winter months due to simple heating problems. In 1964 heated storage cupboards were installed to preheat the individual vinyl biscuits used for each record.[167] These heated cupboards were quickly replaced in December 1965 with the introduction of five semi-automated vinyl pre-heaters.[168] These mundane additions to the production process were carried out in addition to the upgrading of Babelsberg's Swedish and Danish record presses and together contributed to increasing the

[162] 'Economisches Jahresbericht 1963', 17.
[163] Harri Költzsch and Steinert, 'Jahresanalyse 1972' (Deutsche Schallplatten, 21 February 1973), 8, 11, DR 135/52, BArch.
[164] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959', 12; Harri Költzsch and Heinz Neitzert, 'Economisches Jahresbericht 1966' (Deutsche Schallplatten, 24 February 1967), 52, DR 135/51, BArch.
[165] Dr. Rackwitz et al., 'Bericht über eine untersuchung beim VEB Deutsche Schallplatten in der Zeit vom 11.6. bis 24.6.1964', 10.
[166] Harri Költzsch and Heinz Neitzert, 'Jahresanalyse 1970' (Deutsche Schallplatten, 22 February 1971), 6, DR 135/52, BArch.
[167] Dr. Rackwitz et al., 'Bericht über eine untersuchung beim VEB Deutsche Schallplatten in der Zeit vom 11.6. bis 24.6.1964', 6.
[168] 'Economisches Jahresbericht 1965' (Deutsche Schallplatten, 1966), 40, DR 135/51, BArch.

productivity levels of each press by increasing total output and lowering failure rates.[169] While supply problems persisted, rationalisation and expansion efforts at Babelsberg during the 1960s were important precursors to improved production output during the 1970s.

Part 2: Licensing Deals, Recording Studios, and the Deutsche Schallplatten "Model"

Deutsche Schallplatten faced technical challenges other than the logistics associated with pressing records. Upon its formation, Lied der Zeit was short of recording equipment and it often relied on the assistance and generosity of colleagues in Rundfunk DDR and West German record companies.[170] Studio facilities and equipment remained a consistent concern during the early Deutsche Schallplatten-era; an excerpt from a report about a proposed recording involving the Berliner Ensemble and the Berlin Rundfunksinfonieorchester in 1956 gives some flavour of the recording landscape at the time:

> Eine entscheidene Frage ist der Tontechniker, der die Aufnahme leitet. Busch selbst will ausprobieren die Qualität von Rudnik (Deutsches Theater). Göhr hätte eine Möglichkeit, einen sehr gutem Techniker aus Westdeutschland für diese Arbeit zu beschaffen. Noch eine Frage: In welchem Saal könnten die Plattenaufnahmen gemacht werden? In der Akademie der Künste kann nur nach 18.00 Uht bzw. Nachts gearbeitet warden. Der Saal im "LIED DER ZEIT" ist nicht viel besser und ruhiger. Es müsste das Staatliche Rundfunkkomitee einen guten Aufnahmesaal zur Verfügung stellen.[171]
>
> A crucial question is the sound engineer who will lead the recording. (Ernst) Busch wants to try out the quality of Rudnik (Deutsches Theater). (Walter) Göhr can possibly get a very good technician from West Germany for this work. One more question: In which room could the recordings be made? In the Academy of Arts, you can only work after 6 pm or at night. The room at "LIED DER ZEIT" is not much better and quieter. The State Broadcasting Committee would have to provide a good recording room.

[169] 'Economisches Jahresbericht 1965'.
[170] 'Die Entwicklung der Schallplattenindustrie der DDR im 7-Jahrplan #2' (Deutsche Schallplatten, 1957), DR 1/261, BArch.
[171] 'Aufnahmen der Bühnemusiken des Berliner Ensembles: Bericht über die Besprechung mit Walter Göhr' (Deutsche Schallplatten, 5 December 1956), DR 1/255, BArch.

The excerpt suggests a critical lack of recording spaces, as well as the regular use of Rundfunk DDR recordings spaces as a contingency backstop. Deutsche Schallplatten's own recordings studios at Taubenstraße were in habitual use, but its capacity was restricted and its suitability for classical recordings was very limited.

Deutsche Schallplatten was particularly reliant on outside technical assistance for large scale recordings of its major classical performance ensembles, such as the Staatskapelle Dresden and the Thomaskirche Boys Choir.[172] In 1956 the failure of an order by Deutsche Schallplatten for eight condenser microphones from DHZ Elektrotechnik highlighted technical deficiencies at the record company. The order was supposed to replace microphones that had been on extended loan to Deutsche Schallplatten by colleagues from Deutsche Grammophon and which were now due to be returned.[173] Given its limited microphone stock, the situation was a serious threat to Deutsche Schallplatten's ability to continue to make recordings and, despite these stakes, the company found it difficult to arrange funds for repairing the Deutsche Grammophon microphone and importing replacements.[174] Deutsche Schallplatten's negotiation of a route towards a degree of financial independence and technical security began to coalesce during the same year as the above complication. In 1956 Deutsche Schallplatten received a payment of 40,000 DM from Deutsche Grammophon for a collaborative recording made in the Leipzig Kongresshalle.[175] Although this was not the first such arrangement, it does mark the beginning of an escalating pattern of collaboration with Deutsche Grammophon and other West German and Western European record companies on classical music recordings.

Formal recording collaborations between Deutsche Schallplatten and West German record companies became more frequent and the value of stand-alone tape exchanges deals were also quickly realised. By 1957, Deutsche Schallplatten was making focussed technical investments to secure its ability to export licensed tape recordings to the West.[176] The political ramifications of these cultural and economic collaborations with capitalist organisations were initially justified by appeals to gaps in the recorded classical repertoire, but the hard currency

[172] 'Bericht über die Erfüllung des Aufnahmeplanes 1957 des VEB Deutsche Schallplatten'.
[173] Harri Költzsch, 'Harri Költzsch to Alexander Abusch', 18 June 1956, DR 1/255, BArch.
[174] Költzsch.
[175] Költzsch, Neitzert, and Stengel, 'Über die durchgeführte dokumentarische Revision für den Zeitraum vom 1.1.1957 - 30.9.1957', 13.
[176] 'Die Entwicklung der Schallplattenindustrie der DDR im 7-Jahrplan #2'.

income generated by these deals rapidly overcame other rationales.[177] Deutsche Schallplatten became increasingly happy to collaborate on recordings for financial reasons, even if the recorded material didn't fit its own programme requirements:

> Unabhängig davon, ob diese Bänder sofort bei uns ausgewertet werden, sind Aufnahmen solcher Art notwendig.[178]
>
> Regardless of whether these tapes are currently valued by us, recordings of this kind are necessary.

Licensing deals based on tape exchanges became central to Deutsche Schallplatten's recording and infrastructural investment strategies and the record company's equipment procurement policies began to turn away from GDR-designed equipment during this period as it sought to maintain parity with changing international recording standards.[179] In 1957 Költzsch initiated a self-perpetuating technical procurement cycle that became characteristic of the company. Seeking approval from the Ministry for Culture to upgrade recording facilities, Költzsch argued that the substantial cost of a Telefunken recording installation (245,878 VDM) could be paid off in just two years.[180] This was based on projections that Deutsche Schallplatten could bring in 100,000 VDM annually if given permission to exploit licensing income opportunities.[181] Improved equipment and expanded recording capacity allowed Deutsche Schallplatten to steadily increase the amount of recorded material it could offer for licensing, which in turn generated income that maintained technical standards while also financing investment across the entire organisation. The regular import of recording gear from the West by Deutsche Schallplatten distinguished it from the technological recording paradigm at Rundfunk DDR, where a steady policy of internal research and development was maintained. Licensing deals were transformative for Deutsche Schallplatten by enhancing the value of its assets -primarily the GDR's world-renowned performance ensembles - while bypassing its weaknesses. During the 1950s and early 1960s this was largely its weak vinyl record manufacturing base. As the medium of exchange was recording tapes, the deals also enabled

[177] 'Vorlage zum Aufnahmeplan 1958 des VEB Deutsche Schallplatten' (Deutsche Schallplatten, 1957), DR 1/257, BArch.
[178] 'Vorlage zum Aufnahmeplan 1958 des VEB Deutsche Schallplatten'.
[179] 'Ökonomische Jahresanalyse 1956', 7.
[180] Harri Költzsch, 'Harri Költzsch to Hagemann', 6 December 1957, DR 1/257, BArch.
[181] 'Exposé für MAI' (Deutsche Schallplatten, 12 September 1957), DR 1/257, BArch.

Deutsche Schallplatten to deal directly with international partners and evade the complications associated with the export of physical records and onerous interactions with the GDR export infrastructure.[182] In 1959, Deutsche Schallplatten exported just 4,400 physical records to the West, but its licensing income that year was in the region of 210,000 VDM.[183] The export of physical records still retained a greater degree of relevance for the Eastern European market. In 1959, Deutsche Schallplatten exported just over half a million records of various formats eastward, with 40% of this figure comprised of 78s.[184]

By the early 1960s, the licensing and collaborative recording deals made by Deutsche Schallplatten were numerous and diverse, though almost completely focussed on Eterna recordings. An account made by Költzsch of co-operative recordings made in 1960 and 1961 details the variability of the deals made. A 1960 recording of *Elektra* was conducted in the GDR using the Dresdner Staatskappelle under Karl Böhm and soloists contracted to Deutsche Grammophon.[185] A 1961 recording in Berlin of *Tosca* performed by the Berliner Staatskappelle under Horst Stein again used Deutsche Grammophon soloists but was carried out and paid for by Deutsche Schallplatten.[186] By contrast, a recording of *La bohème* with the Berliner Staatskappelle and Staatsoper Chor under Alberto Erede, although carried out in East Berlin, was produced and paid for by Deutsche Grammophon.[187] Co-productions were also carried out with the West German branch of Philips on a series of recording with the Leipzig Gewandhausorchester under Franz Konwitschny.[188] The recordings included Schumann and Beethoven symphonies among other works by those composers, with the recordings costs split evenly between the two record companies. The finalisation of this particular exchange also entailed Philips purchasing the rights to four Amiga recordings, relatively unusual at the time.[189] While the degree to which Deutsche Schallplatten was intertwined with the West German record industry during a period that includes the erection of the Berlin Wall is in itself noteworthy, these interactions were critical to the survival of Deutsche Schallplatten during

[182] 'Die Entwicklung der Schallplattenindustrie der DDR im 7-Jahrplan #2'.
[183] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959', 15.
[184] Költzsch, Harri, 15.
[185] Harri Költzsch, 'Koproduktion 1961', 21 June 1961, DR 1/260, BArch.
[186] Költzsch.
[187] Költzsch.
[188] Költzsch, 2.
[189] Harri Költzsch, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1961' (Deutsche Schallplatten, 26 February 1962), 16, DR 1/260, BArch.

this period and Költzsch distributed the hard currency earned from each of these cross-border exchanges to meet specific infrastructural and material needs.[190]

Deutsche Schallplatten's developing foreign income stream and its impact on the record company's technical infrastructure was assisted by a windfall it experienced in 1959. Plans to refurbish and upgrade the studios at Taubenstraße were cancelled due to the repossession of the record company's headquarters by the Ministry for Trade and Supply, which was expanding its own offices there. In compensation for the enforced move to new premises at Reichtagsufer, Deutsche Scallplatten's moving costs were covered and they were granted 350,000 DM to renovate their new location and build new recording studios.[191] The move to Reichstagufer in itself marked only a small expansion in recording capacity, but the new technical facilities were particularly impactful for the output of Amiga recordings; in 1963 the label nearly doubled its recording minutes target for that year by September.[192] 1963 was also the year that 12" Amiga LPs were pressed for the first time.[193] By 1964, the Reichstagufer studios were already so oversubscribed for Amiga and Litera label (spoken word) recordings that it was causing maintenance issues.[194] This was addressed in 1967 with the construction of a dedicated Amiga facility on Brunnenstraße. Referred to as Studio B or the "Amiga studio", expenditure on outfitting this studio accounted for a considerable proportion of the Deutsche Schallplatten technical budget for the following years.[195] This studio was an important contributor to the increasing success and international profile of Amiga artists and bands during the 1970s, until the recording studio landscape in the GDR began to shift again during the 1980s. Eterna recordings during the 1960s period continued to rely primarily on hired spaces and converted churches, primarily the Lukaskirche in Dresden, but these were also becoming better regulated and equipped with technical upgrades conducted at the Lukaskirche in 1964.[196]

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[190] Költzsch, 'Koproduktion 1961', 21 June 1961.
[191] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959', 9.
[192] 'Stellungsnahme Zum Stand Der Planerfüllung Des VEB Deutsche Schallplatten per 30/9/1963' (Deutsche Schallplatten, 10 August 1963), 5, DR 1/266, BArch.
[193] 'Stellungsnahme Zum Stand Der Planerfüllung Des VEB Deutsche Schallplatten per 30/9/1963', 1.
[194] Dr. Rackwitz et al., 'Bericht über eine untersuchung beim VEB Deutsche Schallplatten in der Zeit vom 11.6. bis 24.6.1964', 6.
[195] 'Economisches Jahresbericht 1967' (Deutsche Schallplatten, 1968), 14, DR 135/51, BArch; 'Economisches Jahresbericht 1968' (Deutsche Schallplatten, 1969), DR 135/51, BArch.
[196] Dr. Rackwitz et al., 'Bericht über eine untersuchung beim VEB Deutsche Schallplatten in der Zeit vom 11.6. bis 24.6.1964', 5.

2.2.1 Vinyl Records in the GDR: Genre Disruption and Production Stabilisation

The introduction of vinyl records in the GDR had unusual interactions with genre, partly due to the strong prioritisation of 45s during the early stages of domestic vinyl record production. This strategy may have been a result of the leadership of Deutsche Schallplatten identifying a broad equivalency between 78s and 45s and consequently prioritising the production of 45s as a direct replacement for 78s – thus positioning the development of LP production as secondary.[197] This institutional viewpoint is further suggested by 1957 plans for the expansion of record production through 1959 and 1960, which envisaged a coordinated alignment in the reduction and increase in the levels of production of 78s and 45s.[198] These plans called for the domestic production of 2 million 45s and 2 million 78s, but just 100,000 domestically produced LPs, augmented by 400,000 LPs under contract to Artia Prague.[199] 45s may have also been appealing to Deutsche Schallplatten in the context of its material supply problems, due to their smaller size and the requirement of less material per unit. While 45s in the GDR did largely assume the former role of 78s as a format dominated by popular music titles, the belated expansion of LP production resulted in a more volatile genre distribution dynamic for that format.

LP production in the GDR only exceeded one million towards the end of the 1960s, but this prefigured major increases during the 1970s, depicted in Figure 2.5. LP production jumped from four to five million between 1969 and 1970, with the majority of this production increase coming from Babelsberg.[200] This impressive increase of LP production in 1970 was exceeded by an increase in the supply of 45s in 1973, when production at Babelsberg more than quadrupled to 3.9 million.[201] Increases in the numbers of records produced and sold in the GDR during the 1970s could be spectacular. In a 1974 regional breakdown of income from record sales - reproduced in Figure 2.6 - the percentage increases from 1970 to 1974 ranged between 200% to nearly 400% in some areas.[202] The overall increase of record production in the GDR

[197] Harri Költzsch, 'Harri Költzsch to Hirsch', 29 August 1957, DR 1/257, BArch.
[198] Költzsch.
[199] Költzsch.
[200] Költzsch and Neitzert, 'Jahresanalyse 1970', 3.
[201] Schmidt and Heinz Neitzert, 'Jahresanalyse 1973' (Deutsche Schallplatten, 15 February 1974), 6, DR 135/52, BArch.
[202] Harri Költzsch and Heinz Neitzert, 'Jahresanalyse 1974' (Deutsche Schallplatten, 17 February 1975), DR 135/52, BArch, Anlage 6.

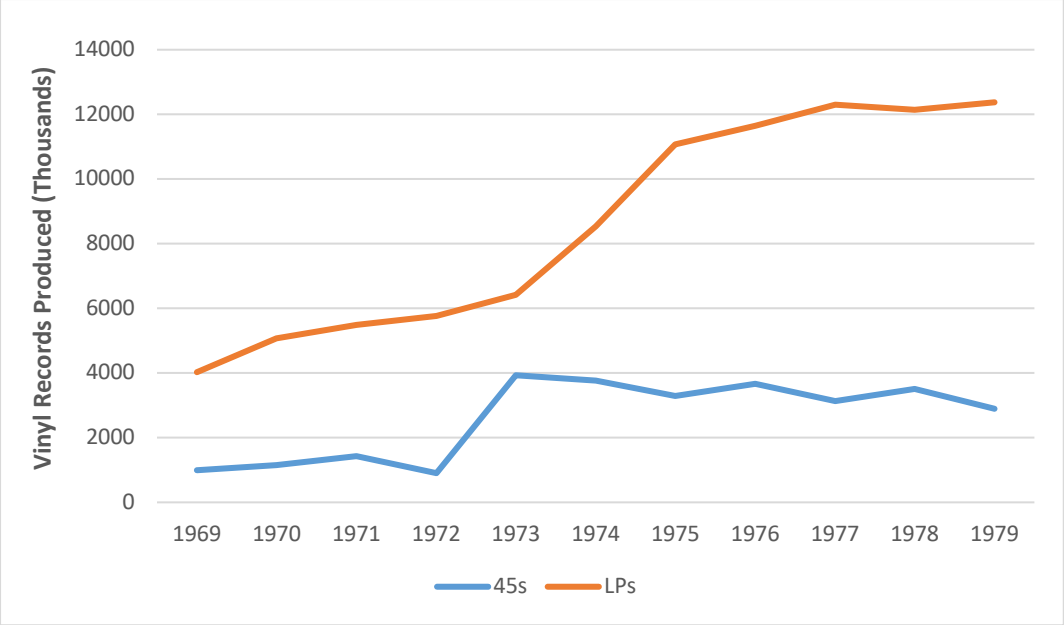
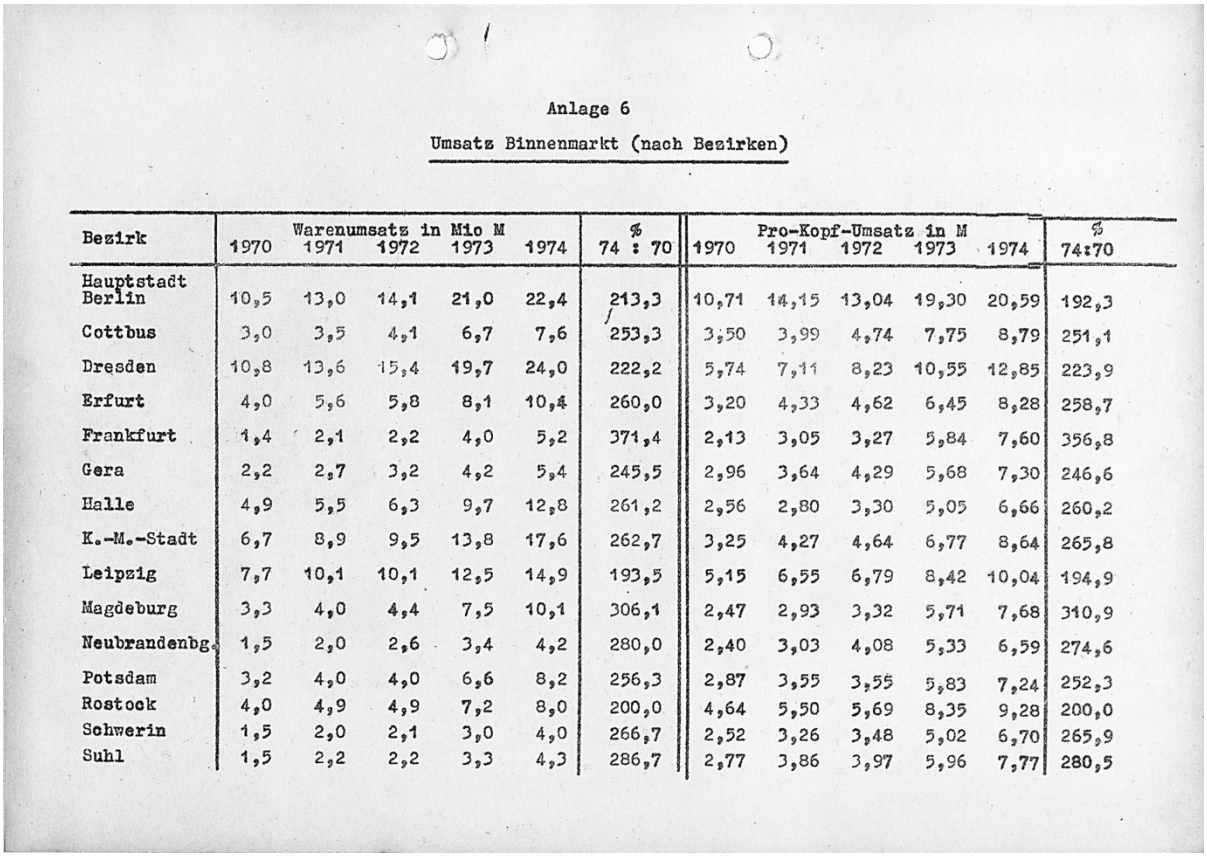


Figure 2.5: Vinyl record production figures for Deutsche Schallplatten between 1969 and 1979. The graph illustrates a transition between two phases of vinyl production: the incremental increases of the 1950s and 1960s and the rapid expansion of the early 1970s. The figures also show the establishment of an LP to 45 production ratio that would remain stable from the mid-1970s until the end of the GDR-era.



Anlage 6

Umsatz Binnenmarkt (nach Bezirken)

Bezirk	Warenumsatz in Mio M 1970	1971	1972	1973	1974	% 74 : 70	Pro-Kopf-Umsatz in M 1970	1971	1972	1973	1974	% 74:70
Hauptstadt Berlin	10,5	13,0	14,1	21,0	22,4	213,3	10,71	14,15	13,04	19,30	20,59	192,3
Cottbus	3,0	3,5	4,1	6,7	7,6	253,3	3,50	3,99	4,74	7,75	8,79	251,1
Dresden	10,8	13,6	15,4	19,7	24,0	222,2	5,74	7,11	8,23	10,55	12,85	223,9
Erfurt	4,0	5,6	5,8	8,1	10,4	260,0	3,20	4,33	4,62	6,45	8,28	258,7
Frankfurt	1,4	2,1	2,2	4,0	5,2	371,4	2,13	3,05	3,27	5,84	7,60	356,8
Gera	2,2	2,7	3,2	4,2	5,4	245,5	2,96	3,64	4,29	5,68	7,30	246,6
Halle	4,9	5,5	6,3	9,7	12,8	261,2	2,56	2,80	3,30	5,05	6,66	260,2
K.-M.-Stadt	6,7	8,9	9,5	13,8	17,6	262,7	3,25	4,27	4,64	6,77	8,64	265,8
Leipzig	7,7	10,1	10,1	12,5	14,9	193,5	5,15	6,55	6,79	8,42	10,04	194,9
Magdeburg	3,3	4,0	4,4	7,5	10,1	306,1	2,47	2,93	3,32	5,71	7,68	310,9
Neubrandenbg.	1,5	2,0	2,6	3,4	4,2	280,0	2,40	3,03	4,08	5,33	6,59	274,6
Potsdam	3,2	4,0	4,0	6,6	8,2	256,3	2,87	3,55	3,55	5,83	7,24	252,3
Rostock	4,0	4,9	4,9	7,2	8,0	200,0	4,64	5,50	5,69	8,35	9,28	200,0
Schwerin	1,5	2,0	2,1	3,0	4,0	266,7	2,52	3,26	3,48	5,02	6,70	265,9
Suhl	1,5	2,2	2,2	3,3	4,3	286,7	2,77	3,86	3,97	5,96	7,77	280,5

Figure 2.6: A breakdown of total regional Deutsche Schallplatten sales between 1970 – 1974. Broadly, the figures depict an expanding market but also demonstrate that the relative proportion of these increases varied significantly by region.[203]

[203] Költzsch and Neitzert, 'Jahresanalyse 1974', Anlage 6.

during the 1970s mirrored similar rates of expansion in the UK record industry (while US record production remained relatively stable), fuelled by falling prices during this period.[204]

Deutsche Schallplatten production figures from 1974 also provide an illuminating snapshot on how genre was now distributed among the record company's release formats. In 1956, the ratio of Amiga to Eterna 78s was more than 10:1 (circa 3,009,000:268,000).[205] In 1974, the ratio of Amiga to Eterna 45s was remarkably similar at 9:1 (2,693,000:296,000).[206] This congruency between the shellac and vinyl eras dissipates in relation to LPs. In 1956, Deutsche Schallplatten issued 50,000 Eterna LPs and just 9,000 for all other genres of music, as the record company prioritised LPs as a prestige format for classical music.[207] Eterna's domination of LP production continued for an indeterminate number of years and this imbalance appears to have been recognised within Deutsche Schallplatten. In a 1969 interview, Költzsch admitted that while the market for classical music recordings in the GDR had been demonstrably expanded, Amiga production was still not matching demand.[208] Költzsch pointed towards a new practice of compiling Amiga singles onto LPs, the creation of a school for songwriters and the inititiation of an annual Schlagerwettbewerb (songwriting competition) as examples of his efforts to develop domestic popular music in the GDR.[209]

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[204] Kevin D. Tennent, 'A Distribution Revolution: Changes in Music Distribution in the UK 1950–76', *Business History* 55, no. 3 (1 April 2013): 333–34, https://doi.org/10.1080/00076791.2012.712963; 'U.S. Sales Database', RIAA, accessed 9 December 2018, https://www.riaa.com/u-s-sales-database/.
[205] 'Schallplattenproduktion (TStck.)'.
[206] Költzsch and Neitzert, 'Jahresanalyse 1974', Anlage 3.
[207] 'Schallplattenproduktion (TStck.)'.
[208] Hans-Joachim Kynaß, 'Ziel für 1969: Den Käufern 1,3 Millionen Langspielplatten mehr - Gespräch mit dem Direktor des VEB Deutsche Schallplatten, Harri Költzsch', *Neues Deutschland*, 15 March 1969, 74 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19690315-0-11-257-0, ZEFYS.
[209] Kynaß.

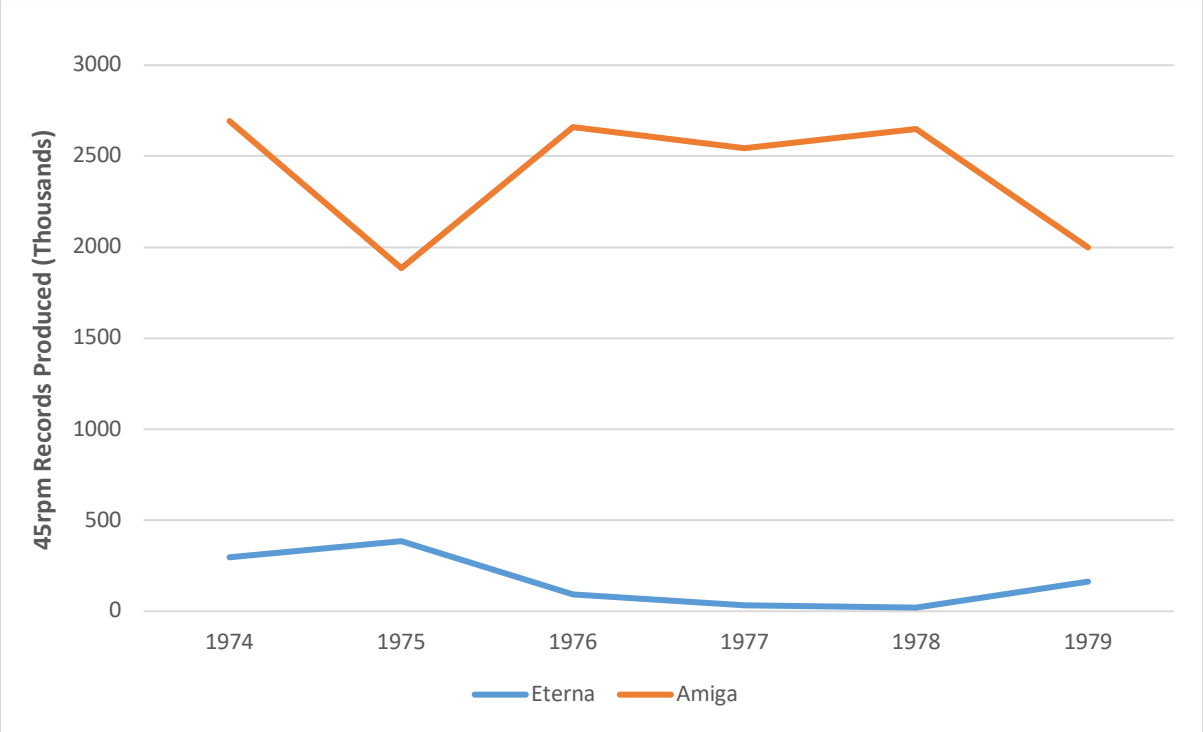

Figure 2.7: Deutsche Schallplatten 45 production figures for its two main music labels, 1974-1979. The large increase in the production of 45s in 1973 was focussed on the Amiga label almost exclusively, in contrast with the focus on Eterna during the early period of vinyl record production in the 1950s.

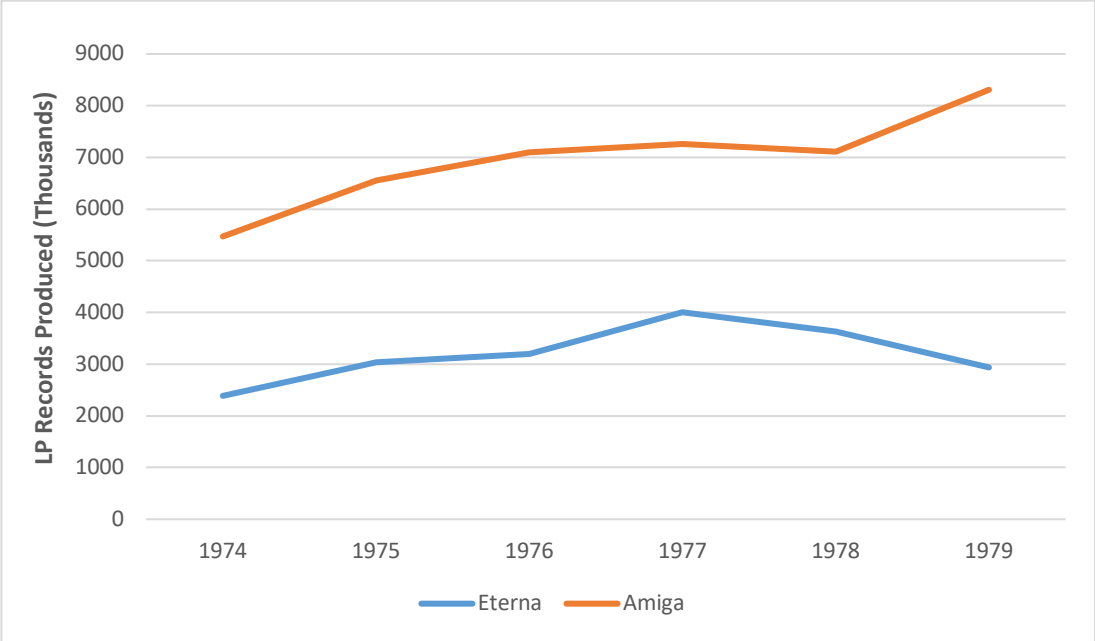

Figure 2.8: Deutsche Schallplatten LP production figures for its two main music labels, 1974-1979. It was during this period that the company reached peak capacity and the relative ratio established between the two labels by 1979 remained stable into the 1980s.

Deutsche Schallplatten production figures for the late-1950s and the 1960s are not conclusive on genre distribution and thus they do not make it clear when the crossover occurred, but by 1974 - at the latest - Amiga LP production had decisively overtaken Eterna. That year Deutsche Schallplatten produced 5,470,000 Amiga LPs and 2,387,000 Eterna LPs, a

ratio of a little more than 2:1.[210] The production of 45s by Deutsche Schallplatten after 1974 stabilised at between 3 and 3.5 million for the rest of the decade and did not exceed four million until the mid-1980s.[211] While the established ratio of Amiga and Eterna 45s within these production figures remained relatively stable during the 1970s - depicted in Figure 2.7 - the ratio of Amiga to Eterna LP production continued to resolve in favour of Amiga. Total production of LPs by Deutsche Schallplatten plateaued at just over 12 million between 1977 and 1979 and did not exceed this level during the 1980s.[212] The relative proportion of Amiga to Eterna LPs stabilised around 1979 at close to 3:1 (8,308,000:2,936,000); the establishing period of this consistent pattern of LP distribution is depicted in Figure 2.8.[213] The maintenance of these absolute and relative production levels through the 1980s suggest that Deutsche Schallplatten had either reached the practical limits of its production capacity or it had saturated the domestic market. This thesis does not wish to suggest that GDR-specific cultural policies were the only driver behind the changing genre distributions described above; the widespread use of LPs for popular musics was not characteristic of the record industry during the 1950s and early 1960s. However, it is clear that cultural-political conditions in the GDR - set against the backdrop of the strategies it took in introducing vinyl record production - had a substantial impact on the character of record format distribution in Deutsche Schallplatten's output.

Deutsche Schallplatten's production increases of the late-1960s and 1970s also had expression in how it promoted and organised its releases. This was particularly impactful for Amiga. In 1970, Amiga was still chiefly focussed on EP releases; that year it released fifty new titles on 45 with an average run of 11,500 discs.[214] During the early 1970s, Deutsche Schallplatten continued to enact new approaches for expanding Amiga sales; one of the most of these was to collect successful single releases onto compilation LPs.[215] One of the first of these was *Rhythmus '71*, which sold more than 100,000 copies.[216] This was a landmark for the label and similar compilation records became a cornerstone of Amiga release schedules. Four other Amiga releases sold over 100,000 records in 1974, although maintaining the supply of

[210] Költzsch and Neitzert, 'Jahresanalyse 1974', Anlage 3.
[211] 'Geschäftsbericht 1987' (Deutsche Schallplatten, 1988), 3, DR 135/44, BArch.
[212] 'Geschäftsbericht 1979' (Deutsche Schallplatten, 1980), Anlage 3, DR 135/36, BArch.
[213] 'Geschäftsbericht 1979', Anlage 3.
[214] Költzsch and Neitzert, 'Jahresanalyse 1970', 5.
[215] Harri Költzsch and Heinz Neitzert, 'Jahresanalyse 1969' (Deutsche Schallplatten, 3 February 1970), 11, DR 135/52, BArch.
[216] Harri Költzsch and Heinz Neitzert, 'Jahresanalyse 1971' (Deutsche Schallplatten, 23 February 1972), 4, DR 135/52, BArch.

these hit records was sometimes precariously managed.[217] These kinds of releases and the improved promotional policies that accompanied them were credited with helping significantly improve the label's relationship with Rundfunk DDR, Fernsehen der DDR and the GDR's live-music infrastructure and they also helped pave the way for full-album LP releases by GDR artists during the later 1970s.[218] During the 1970s, Amiga managed to sustain a consistent level of success and a widening range of artists achieved similar levels of sales. The successful Amiga records of the 1970s were accompanied by a change of engagement and rhetoric within the Deutsche Schallplatten administration. Annual reports from the beginning of Deutsche Schallplatten's formation regularly feted the achievements of the Eterna label and habitually detailed some of the most successful composers, works and soloists recorded in a given year. By contrast, Amiga's annual assessments during the 1950s and 1960s were generally conducted in broad generalities, despite consistently making up a greater proportion of overall domestic sales. As the 1970s progressed and Amiga acts began to achieve foreign success to match their domestic sales, names like Puhdys, Karat, City and Veronika Fischer became regular features of Deutsche Schallplatten's annual reports as the company's appreciation of popular music became more sophisticated. In Deutsche Schallplatten administrative records during the 1950s and 1960s, the majority of Amiga recordings were placed under broad pre-war genre categories such as "Tanzmusik" or "Unterhaltungsmusik" music. From 1972 genre terms like "Schlager" ("hit music"/pop music) and "Beatmusik" and descriptors like "Hartebeat" ("hard beat", a Germanic synonym for the rock 'n' roll back beat) belatedly became more prevalent within the organisation and were increasingly recognised in its strategic development plans.

Licensing remained a significant source of income for Deutsche Schallplatten throughout the 1970s and 1980s. In 1978, 75% of all Eterna recordings were either co-produced with or licensed to Western record companies and a large proportion of Deutsche Schallplatten's classical output was available worldwide due to this enduring strategy.[219] In 1979, 90% of Eterna recordings had international distribution deals.[220] Amiga recordings began to play a more significant role in Deutsche Schallplatten's foreign licensing activities during the late 1970s and the band Puhdys, in particular, was important to this development. The

[217] Költzsch and Neitzert, 4.
[218] Költzsch and Steinert, 'Jahresanalyse 1972', 5.
[219] 'Geschäftsbericht 1978' (Deutsche Schallplatten, 1979), 22, DR 135/52, BArch.
[220] 'Geschäftsbericht 1979', 15.

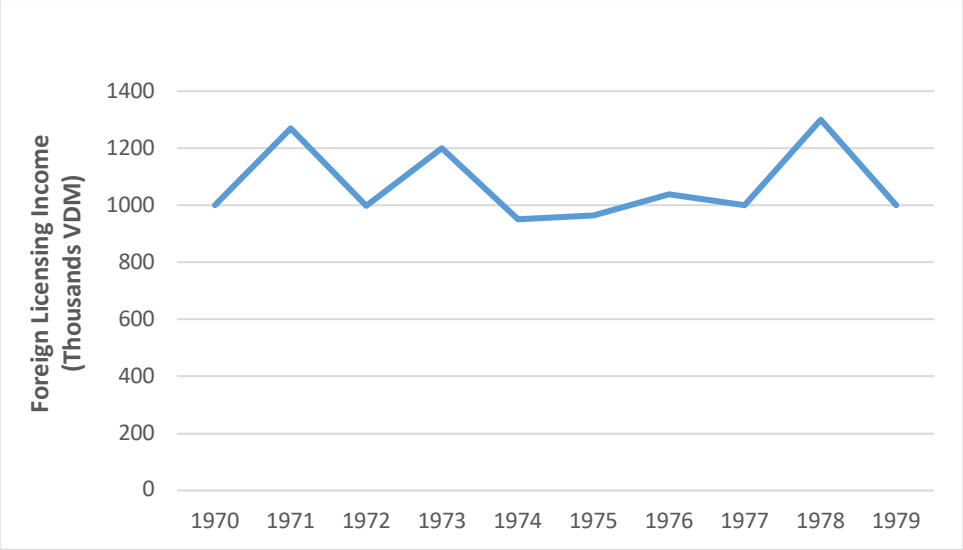

Figure 2.9: Total Deutsche Schallplatten foreign licensing income, 1970-1979. This hard currency stream was critical to the development of Deutsche Schallplatten's recording infrastructure. From 210 kVDM in 1959, this income expanded rapidly during the 1960s, but by the 1970s it was comparatively static.

Puhdys were the most successful GDR band in both domestic and foreign sales and their career usefully expresses recurring tensions and inconsistencies within the GDR's treatment of popular music. In 1977, the Puhdys' second and third albums sold well across Europe and they were awarded "Sonderklasse" ("special status") within the GDR's regimented performance and recording infrastructure; this granted them a guaranteed income and enabled them to tour and record in Western Europe.[221] They repaid this treatment with continued success and combined sales of nearly 400,000 records in 1979.[222] Bands like Karat followed the Puhdys' model and helped solidify Amiga success by selling more than 200,000 LPs in that same year.[223] However, the aesthetics of both bands were largely based on Western influences and, along with many of their peers, they were almost completely reliant on "West-Technik" or Western-manufactured musical equipment, largely secured through back-channels established with bands in Bulgaria, Hungary and Poland.[224] This transgressive technical equipment was the focus of an incident that took place during the band's early period of major success. In 1974, the band were part of a line-up including Klaus Renft Combo, Electra and Prinzip for a concert held at the Berliner Friedrichstadtpalast to launch the *Rhythmus '74* compilation LP.[225] The

[221] Harri Költzsch and Heinz Neitzert, 'Geschäftsbericht 1977' (Deutsche Schallplatten, 15 February 1978), 19, DR 135/52, BArch; Irmela Hannover, *Puhdys: Eine Kultband Aus Dem Osten* (Berlin: Elefanten Press, 1994), 55.
[222] 'Geschäftsbericht 1979', 4.
[223] 'Geschäftsbericht 1979', 4.
[224] Hannover, *Puhdys: Eine Kultband Aus Dem Osten*, 53.
[225] Hannover, 55.

concert was used as an opportunity by GDR customs officials to stage a raid with the intention of seizing illegally-imported musical equipment.[226] The raid led to a stand-off; customs officials were faced-down by staff from the Ministry for Culture advocating for the GDR's top-performing bands of the period, who faced the effective crippling of their sanctioned activities due to conflicting impulses within separate organs of the state.[227]

The contribution of bands like Puhdys to Deutsche Schallplatten's foreign licensing income never approached the levels attained by Eterna's long-established commercial relationships with foreign record companies, but Amiga's improved international success was nevertheless significant to maintaining the stability of that income. In the late 1950s, Deutsche Schallplatten's foreign licensing income was in the region of 200,000 to 300,000 VDM per year.[228] Alongside improving vinyl record production, this income expanded rapidly during the 1960s, but plateaued during the 1970s at around 1,000,000 VDM, as shown in Figure 2.9. Amiga's expanding contribution was critical in that context - and was recognised by Deutsche Schallplatten as such - as licensing income continued to finance ongoing infrastructural technical upgrades.[229] During the 1970s, these upgrades included a brief focus on quadrophonic recording at the Lukaskirche.[230] Licensing income also contributed to the relative ease with which Deutsche Schallplatten introduced its first new consumer format in more than a decade: audio cassette tapes.[231] First produced in 1970, tape production escalated rapidly during the 1970s - also shown in Figure 2.10 - and continued to expand during the 1980s, exceeding 3 million in 1987.[232] Despite some quality-control issues, Deutsche Schallplatten had considerable success with the format, particularly with Christmas-compilations, comedy recordings and fairy-tale tapes aimed at children.[233]

Deutsche Schallplatten during the 1980s was characterised by the continuation of many of its successful long-term policies and stable production trends, but there were some technical shortcomings as well as a degree of destabilisation to its Amiga recording model. A focus on maintaining technical standards for Eterna recordings continued with the purchase of stereo

[226] Hannover, 55.
[227] Hannover, 55.
[228] 'Bericht über die Erfüllung des Aufnahmeplanes 1957 des VEB Deutsche Schallplatten'; Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959'.
[229] Költzsch and Neitzert, 'Geschäftsbericht 1977', 19; 'Geschäftsbericht 1978', 20.
[230] Költzsch and Neitzert, 'Jahresanalyse 1971', 9, 15.
[231] Költzsch and Neitzert, 9, 15.
[232] 'Geschäftsbericht 1987', 3.
[233] 'Geschäftsbericht 1978', 6.

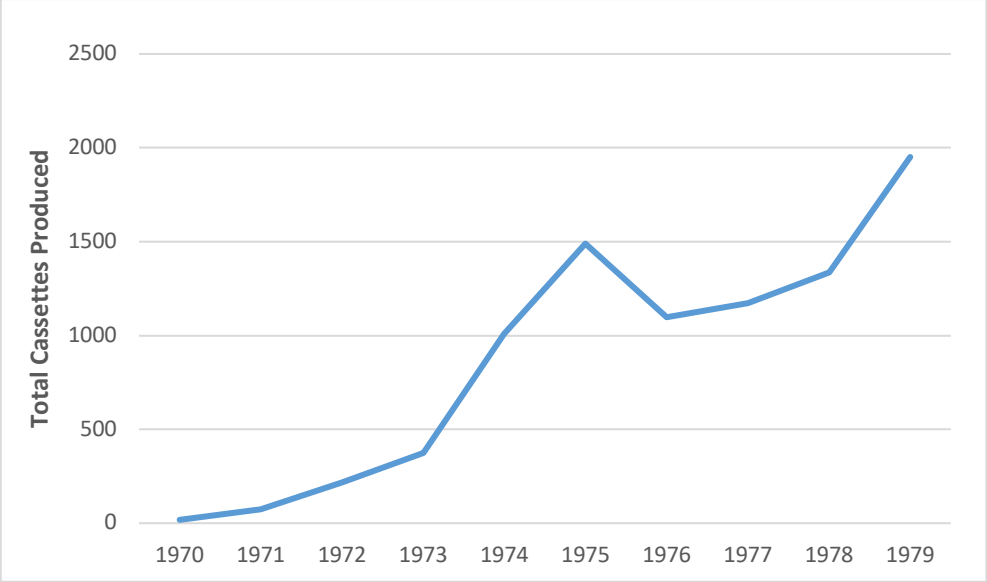

Figure 2.10: Total Deutsche Schallplatten audio cassette production figures 1970-1979. The record company had issues with tape formulations and label printing, but the introduction of audio cassettes was relatively unproblematic in comparison with previous formats.

digital recorders in 1984.[234] Deutsche Schallplatten also invested in Direct Metal Mastering (DMM) vinyl record lathes in the same year.[235] The money spent on these two upgrades accounted for 64% of Deutsche Schallplatten's technical expenditure in 1984.[236] Although the merits of DMM have been debated, it was the technological peak of vinyl mastering technology at the time and was seen as a prerequisite for the continued prestige of Eterna recordings. In 1987, the LP presses at Babelsberg were upgraded to accommodate the new standard and more than a million records pressed that year bore the DMM imprimatur.[237] Deutsche Schallplattten's cassette production line was improved in 1987; of 3 million total cassettes produced, 500,000 utilised improved CrO_2-formulation tape and 230,000 of these were dubbed from digital recordings.[238] However, there were areas of recording and record production where Deutsche Schallplatten was not on pace with international developments. In 1987, digital multi-track recordings relied on the contributions of international collaborators and in 1988 Deutsche Schallplatten was only just beginning to investigate processes for creating glass masters for CD replication.[239]

[234] Harri Költzsch, 'Geschäftsbericht 1984' (Deutsche Schallplatten, 11 February 1985), 6, DR 135/41, BArch.
[235] Költzsch, 11.
[236] Költzsch, 6.
[237] 'Geschäftsbericht 1987', 4.
[238] 'Geschäftsbericht 1987', 4.
[239] Martin Meyer, 'Geschäftsbericht 1988' (Deutsche Schallplatten, February 1989), 15, DR 135/45, BArch; 'Geschäftsbericht 1987', 2.

Since the mid-1960s, Deutsche Schallplatten made regular provision for the construction of a recording infrastructure to serve the Amiga label – largely based on the technical model of commercial Western recording studios – alongside its more comprehensive expenditure on enhancing Eterna recordings. The results of these tandem policies can be discerned from a technical assessment of Deutsche Schallplatten's recording facilities compiled in January 1990. Equipment lists from Deutsche Schallplatten's Eterna and Amiga studios all exhibit a diverse range of industry standard loudspeakers, tape machines, microphones – predominantly Western imports with relatively few instances of GDR-manufactured equipment. A notable exception in this regard are the recording desks used in the various recording facilities. Only the two studios at the Amiga facility on Brunnenstraße had Western-manufactured desks - a 1967 Telefunken desk and a more modern US-built MCI JH 600 with Audio Kinetics automation - all the other studios had recording desks built by Deutsche Schallplatten technicians. The most recent of these was the 36-channel desk installed at the Lukaskirche in 1988, which featured VCA control.[240] Despite these technical provisions, Deutsche Schallplatten's relative monopoly on recording studios was disrupted during the 1980s as successful Amiga recording artists began to take advantage of opportunities to record abroad and a small number of private recording studios also emerged within the GDR. By 1987, the increasing proportion of Amiga recordings from foreign studios was a noted trend and in 1988 more than half of Amiga's one hundred new releases for the year were produced in one of the GDR's private recording studios.[241] Martin Meyer, Deutsche Schallplatten's new general director and the former Deputy Minister of Culture, was not averse to Amiga artists making recordings in professional studios in West Berlin, but he was less enthused by the new trend of "semi-professional" private studios within the GDR.[242] Meyer acknowledged that the current technical set-up at the Amiga studio on Brunnenstraße made the achievement of some types of contemporary recordings difficult to attain, but he attributed the lack of quality he observed in some Amiga recordings of 1988 to external contributors:

> Es gab eine ganze Reihe absatzstarker Neuveröffentlichungen, die zu einem Teil freilich an der unteren Grenze des zu fordernden inhaltlichen, akustischen und

[240] 'Aufnahmeeinheiten der Studios von VEB Deutsche Schallplatten' (Deutsche Schallplatten, 29 January 1990), Anlage 13, 3, DR 135/57, BArch.
[241] 'Geschäftsbericht 1987', 2; Meyer, 'Geschäftsbericht 1988', 3, 10.
[242] 'Neuer Direktor des VEB Deutsche Schallplatten'; Meyer, 'Geschäftsbericht 1988', 3.

> musikalischen Qualitätsstandards lagen. Das betrifft vor allem Übernahmen aus Rundfunk, Fernsehen oder Privatstudios.[243]
>
> There were a number of high-volume new releases, some of which were at the lower end of the demanding content, acoustic and musical quality-standards. This mainly applies to acquisitions from radio, television or private studios.

Meyer requested that the Ministry of Culture arrange for the central regulation of access to private recording studios as part of a modernising plan to run from 1991 to 1995.[244] These plans were never enacted as Deutsche Schallplatten largely ceased to be run as an active record company after the fall of the Berlin Wall and its publishing rights and holdings were sold to third parties.

2.2.2 Conclusion

Deutsche Schallplatten's activities as a record company notably bridge the period during which vinyl records were the dominant consumer music format and its primary successes and failures relate to this medium. Until the mid-1950s the primary challenge for the GDR record industry was the restoration of a domestic supply of 78rpm gramophone records. The disruption caused by the introduction of vinyl records was devastating for the company and from 1956 until the early 1960s, Deutsche Schallplatten faced an existential threat as it found itself in the midst of a major technological format-shift for which it was ill-prepared. Deutsche Schallplatten made focussed improvements to its recording and production infrastructure during the 1960s, but it wasn't until the 1970s that its production base began to produce records in quantities commensurate with domestic demand. Deutsche Schallplatten did not have the legacy resources of the major West German record companies, but commercial relationships with West German and other international record companies and the foreign licensing income derived from these partnerships were key to the large-scale infrastructural improvements that Deutsche Schallplatten slowly made over several decades.

[243] Meyer, 'Geschäftsbericht 1988', 2.
[244] Meyer, 32.

Material shortages, infrastructural failures and administrative mishandlings were central to Deutsche Schallplatten's challenges with record production, but complex interactions between GDR cultural priorities and the pursuit of foreign licensing income also contributed to the atypical character of the introduction of vinyl record formats to the GDR. A prolonged emphasis on preserving and augmenting the classical music recordings of the Eterna label due to their international value influenced unusual dynamics within the genre distribution of Deutsche Schallplatten's vinyl record production output, which require additional investigation and analysis beyond that offered in this chapter. Popular music did receive steadily improved attention and resources from Deutsche Schallplatten from the 1960s onwards and the significant domestic and international success of some Amiga artists during the 1970s and 1980s was aided by these progressive policies. As the GDR-era came to a close, Deutsche Schallplatten had a stable recording and record production infrastructure, regularly augmented by steady (though potentially stagnating) foreign licensing income. Impending recording technology and consumer format changes would have tested this model again, but the folding of the company after the Wende obviated this eventuality. Deutsche Schallplatten recordings of diverse types continue to be remastered and reissued and both the quality of its classical recordings and the enduring popularity of some of its Amiga artists attest to the contribution it made to the GDR cultural landscape.

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Chapter 3: Stereo Narratives and the GDR, 1947-1970

Audio infrastructures in Europe during the post-war period were initially characterised by the restoration of pre-war structures, but new media forms and technologies for music and broadcasting began to arrive rapidly during the early 1950s. One of the most interesting developments in sound technology in the early years of the Cold War was the final coming-to-fruition of stereophonic recording. Using two or more sound channels to present a soundscape distinctively different than what is possible from a monophonic sound source, stereo was consistently portrayed in contemporary academic and commercial spheres as a major qualitative advance for sound reproduction. The acoustician Vilhelm Lassen Jordan likened monophony to listening with "one ear close to a small hole in one wall of the studio".[1] By contrast, stereo's comparative width and perception of spaciousness supposedly removes this wall and invites the listener within the recording space – although attributions of realism or verisimilitude to stereo are problematic.[2] Stereo remains the default audio format for much of contemporary music recording and radio and TV broadcasting. Although conceptually relatively straightforward, the development and execution of stereo sound was protracted and multi-faceted. Experiments with multi-channel audio are nearly as old as recording itself, but until the mid-1950s the overwhelming majority of recorded sound remained monophonic. The associated audio technologies and infrastructures of the early twentieth century were all rigidly monophonic formats and stereo's eventual arrival was thus a significant test of the robustness of these audio infrastructures in the face of transformative technological change. In the US, where stereo was standardised and commercialised, the post-war economic boom fuelled expansion in the record industry and enabled an increasing interest in high fidelity; important components of the general context that allowed stereo to become a viable mass media format. In the GDR, the introduction of stereo was more closely linked to political and cultural ideologies, whereby the absence of stereo could be viewed as an implicit criticism of the wider GDR project.

Stereo was just one of several technological media forms that flourished in the post-war period. Although the GDR perceived Western cultural imports as an ideological threat and

[1] Vilhelm Lassen Jordan, *Acoustical Design of Concert Halls and Theatres: A Personal Account* (London: Applied Science Publishers, 1980).
[2] Jonathan Sterne, 'Compression: A Loose History', in *Signal Traffic: Critical Studies of Media Infrastructures*., The Geopolitics of Information Ser (Champaign: University of Illinois Press, 2015), 33.

actively attempted to restrict their flow into the GDR, it adopted identical technological forms in order to construct parallel cultural infrastructures that could counterbalance the output of the West. The compatibility of these domestic infrastructures with those of the West meant the GDR actually helped to enable cross-border media exchanges and Western cultural imports were never successively excluded. One of the main challenges for the GDR economy was matching pace with international technological developments. The handling of the gramophone and vinyl record changeover during the mid-1950s discussed in Chapter 2 provides an example of a cultural industry in the GDR that was clearly unprepared for a major technological shift. In comparison, the introduction of stereo recording and stereo broadcasting in the GDR was better coordinated. Although stereo involved a large range of technical developments across a wide group of GDR companies and organisations, it was largely self-coordinated with little direct control by central government other than broad policy directives. While GDR technical narratives are replete with examples of the state trying to catch-up with international technological developments, the introduction of stereo to the GDR has particular historical undertones due to Germany's technical contributions to the development of viable stereo media.

3.1 Early Stereo, Technological Transfers and the Settling of Stereo Formats

Essential strides were made with stereophonic sound experiments during the 1930s and 1950s, but the stereo had a long experimental pre-history. The earliest known stereophonic experiment was run during the 1881 Paris Electrical Exhibition. This experiment utilised a dual telephone circuit running from the Paris Opera house to the exhibition centre; both circuits fed a signal of the live performance taking place at the opera house to the ears of the listener.[3] In 1925, the Berlin Opera House was the site for a similar experiment.[4] Motivated by an envisaged listener subscription service, this experiment involved multiple microphones and several phone lines.[5] In 1933, Bell Labs similarly used telephone lines to transmit a performance of the Philadelphia Symphony Orchestra on a three-channel system to an audience in Washington DC.[6] A commonality between all these early stereo systems was that they were all for live

[3] Harold T. Sherman, 'Binaural Radio Broadcasting', *Audio Engineering*, January 1953, 14, americanradiohistory.com.
[4] Ludwig Kapeller, 'Radio Stereophony', *Radio News*, October 1925, 545, americanradiohistory.com.
[5] Kapeller, 546.
[6] H. Fletcher, 'Auditory Perspective - Basic Requirements', *Electrical Engineering* 53, no. 1 (January 1934): 9–11, https://doi.org/10.1109/EE.1934.6540356.

performances; the limitations of contemporary recording equipment made it extremely difficulty to encode multiple simultaneous recording. Alan Dower Blumlein famously had success grappling with several of the many technical and theoretical challenges presented by stereo while working for Columbia and EMI Records in England during the early 1930s. This included experimenting with several methods of recording multi-channel sound: these methods included etching double grooves to disc and recording multiple channels to optical film.[7] Optical film was the solution utilised for the first major exposure of stereophonic sound to a broad public: Disney's *Fantasia* in 1940.[8] While technologically sophisticated, the methods used by *Fantasia* were prohibitively expensive for general use. Stereo was still just a novelty, and, after *Fantasia,* general audiences did not experience stereo sound again to any substantial degree until the 1950s.

A key progression towards making stereo a viable format was the maturation of magnetic tape recording that took place in Germany during the 1930s and 1940s. However, the applicability of magnetic tape towards stereo usage was not the primary motivation for its development and its suitability for this role was only realised subsequently. Magnetic recording tape offered many important advantages for recording that included recording duration, sound quality and the ability to re-record. Germany was at the forefront of magnetic recording development from the 1920s through until the 1940s. Magnetised steel wire was the initial medium of choice and was used in dictation machines during the 1920s and 1930s. The magnetised medium used in Germany rapidly progressed from steel wire to steel tape and then to paper tape coated in ferric oxide.[9] In the early 1930s two of Germany's largest manufacturers, AEG and IG Farben, collaborated on the development of a new tape recorder utilising a plastic-based recording tape formulation. The Magnetophon was launched at the Berlin Exhibition in 1935.[10] It was the first tape recorder to use plastic tape, which proved to be a much more reliable and robust base than paper for the sound-carrying magnetic layer. The Magnetophon had significantly better sound characteristics than wire-based recordings. With a frequency response that extended to 10 kHz, the Magnetophon gained about an octave in comparison to a contemporary gramophone record.[11] The Magnetophon's qualitative capabilities were

[7] Robert Charles Alexander, *The Inventor of Stereo: The Life and Works of Alan Dower Blumlein* (Oxford: Focal Press, 1999), 75.
[8] E. Garner Louis Jr., 'Stereo: Then and Now', *Radio Electronics*, March 1959, 54.
[9] Mark Mooney Jr., 'The History of Magnetic Recording', *HI-FI Tape Recording*, February 1958, 24, americanradiohistory.com.
[10] Mooney Jr., 24.
[11] Mooney Jr., 28.

unsurpassed during the Second World War; the BBC and broadcasters in the US continued to rely on wire- and steel tape-based magnetic recording devices during this period.[12] From about 1944 the US was beginning to develop paper-tape based recording, but German tape recording capabilities had continued to improve during the war with the application of AC bias in 1942.[13] This process involves the use of an inaudible high-frequency signal that improves the responsiveness of recording tape to the recording signal.

After the war, the US took over the impetus in the development of magnetic recording technology, though largely based on the example provided by German recorders. Richard H. Ranger and John T. Mullin, both US Army Signal Corps officers stationed in Germany in 1945, were pivotal in bringing the German advances to the US. Ranger was involved in the assessment of the AEG factory in Berlin. This factory was the centre of Magnetophon production and eighteen Magnetophons were divided among the Western Allies, with five of these staying with the US Army.[14] On his return to the US, Ranger began to give lectures on the devices and distributed the parts among the US audio industry, characterising this as the "finest reparations we could get".[15] Mullin came across the Magnetophon in Frankfurt; he disassembled two and posted them to the US along with 50 reels of tape. Mullin began to give demonstrations of the Magnetophon in 1946 and became a consultant for the electronics company Ampex.[16] The parallel activities of Ranger and Mullin came to quick fruition. In 1947 the US manufacturing corporation 3M made significant improvements to the capabilities of Magnetophon-type recorders by improving the tape formulation.[17] In the same year Mullin was contracted by Bing Crosby to record his live radio show to facilitate repeat broadcasts for US radio markets in different time zones. In April 1948, Crosby's show was recorded for the first time using an Ampex 200.[18] Magnetic tape recorders quickly became widespread and wire recorders were soon defunct in US broadcasting. The Magnetophon also had a direct influence on the development of tape recorders in Britain. This began with the design and construction by EMI of the British Tape Recorder 1 (BTR1) in 1947, directly based on the German device

[12] 'How Broadcasting House Is Run', *BBC Year Book 1934*, 1934, 52.
[13] Mooney Jr., 'The History of Magnetic Recording', 24; Werner Stankoweit, 'Studiotechnik Rundfunk: Zusammenfassung der Unterlagen über die Entwicklung der Technik des Rundfunks bis 1967, Band I' (Rundfunk DDR, 1967), 39, Deutches Rundfunk Archiv.
[14] Mooney Jr., 'The History of Magnetic Recording', 28.
[15] Mooney Jr., 28.
[16] Mooney Jr., 29.
[17] Mooney Jr., 29.
[18] Mooney Jr., 28.

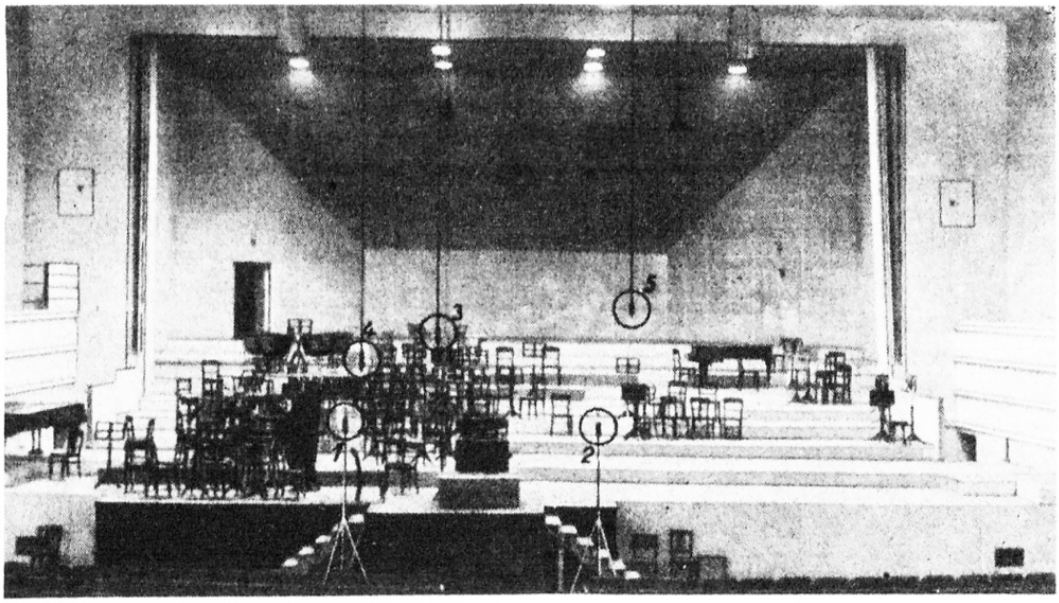

Figure 3.1: Sendesaal I at Haus des Rundfunks, Berlin in 1947 during the Hertz stereo experiment. The microphones on floor stands labelled 1 and 2 made the stereo recording.[19]

with some additional research.[20] An improved design, the BTR2, was built in 1953. This model remained in widespread usage for twenty years with hundreds in use by EMI, the BBC, Decca and others.[21] Blumlein and *Fantasia* had previously demonstrated the suitability of tape formats for encoding multiple audio tracks and once magnetic tape recorders were established in the US, their conversion for stereo use was almost immediate. Music recording had been an integral component or motivation behind most previous stereo efforts, but the Magnecord company first began making stereo recorders at the request of General Motors; the automotive company saw application for stereo recordings in its factories as an analytic listening tool.[22] Magnecord's stereo recorder was demonstrated at the first Audio Engineering Society (AES) Audio Fair in 1949. This was the first public demonstration of a stereo format that would go on to be developed for wide-spread professional and consumer use.

During the war, the original Magnetophon design was used to create some of the earliest-surviving stereo recordings of a live musical performance.[23] These were made in

[19] W. Lippert, 'Stereophonische Zweikanalübertragung mit dem Magnetophon', *Funk und Ton*, no. 5 (1947): 243.
[20] Kevin L. Ryan, *Recording the Beatles: The Studio Equipment and Techniques Used to Create Their Classic Albums* (Houston, Texas: Curvebender Publishing, 2009), 198.
[21] Ryan, 200.
[22] Mooney Jr., 'The History of Magnetic Recording', 32.
[23] Gerhard Steinke and Wolfgang Hoeg, 'Mehrkanalübertragung im Rundfunk: Rückblick und Ausblick aus Anlaß der Betriebseinführung der Stereofonie im Rundfunk der DDR vor 10 Jahren', *Technische Mitteilungen des RFZ* 18, no. 3 (1974): 75.

Sendesaal I at Haus des Rundfunks by Helmut Krüger in 1943 and 1944.[24] These efforts were revisited in a well-documented post-war stereo recording session made with a modified Magnetophon. This experiment was conducted by Werner Lippert of the Hertz Institute in Berlin in 1947, again in Sendesaal I.[25] The well-renowned Hertz Institute had been renamed during the War due to Hertz's Jewish roots, but it was reformed in 1945. It was initially funded by the Soviet-founded Deutschen Akademie der Wissenschaften and was based at Haus des Rundfunks during the era of the Berliner Rundfunks broadcaster, moving to West Berlin shortly later.[26] Lippert's experiment was a parallel mono and stereo orchestra recording session. Using a Magnetophon reconfigured to record two tracks to a single tape, the intention of the experiment was to examine the feasibility of a range of stereo recording techniques and to test the suitability of the customised Magnetophon as a stereo platform. This was still in advance of Ampex producing its monophonic tape recorder and Magnecord's stereo tape recorder. The mono recording made at the session was used as a control and carried out using three microphones (labelled 3, 4 and 5 in Figure 3.1) following established recording conventions at Haus des Rundfunks.[27] The stereo recording was influenced by one of Blumlein's published recording techniques. Lippert used a pair of Neumann condenser microphones as a stereo AB pair (labelled 1 and 2), one each on either side of the conductor four metres apart. The results of the session were largely positive and Lippert was convinced that stereo offered definitive advantages over mono recording, while acknowledging that further experimentation was required.[28]

Lippert's results were achieved despite the acknowledged limitations of the modified Magnetophon used; the recording unit and the tape stock used did not benefit from the material and technical advances that were being made in the US in the same year. In actuality, the engineers at the Hertz Institute had to make serious compromises to the Magnetophon's existing technical specifications to make it capable of stereo recording. For magnetic tape recording, two of the main factors that contribute to audio quality are tape running speed and tape width. The Magnetophon used 6.5mm tape and standard monophonic recordings assigned

[24] Gerhard Steinke and Gisela Herzog, *Der Raum ist das Kleid der Musik: Musik-Aufnahmesäle und Hörspielstudios im Funkhaus Berlin-Nalepastrasse sowie weitere Aufführungs- und Hörräume* (Berlin: Verlag Kopie & Druck Adlershof, 2012), 177.
[25] Lippert, 'Stereophonische Zweikanalübertragung mit dem Magnetophon', 236.
[26] 'The Institute's Reconstruction – Fraunhofer Heinrich Hertz Institute', accessed 22 May 2018, https://www.hhi.fraunhofer.de/en/fraunhofer-hhi/about-us/history-of-hhi/90-years-hhi/the-institutes-reconstruction.html.
[27] Lippert, 'Stereophonische Zweikanalübertragung mit dem Magnetophon', 243.
[28] Lippert, 248.

the entire bandwidth to a single channel of audio. The Hertz Institute experiment divided this available bandwidth into two separate audio tracks of 2.75mm, which directly impinged on the dynamic range of the recording. Single channel Magnetophon recordings had a standard dynamic range of about 60dB; the bandwidth reduction for Lippert's stereo experiment reduced the dynamic range to about 42 dB per channel.[29] The bandwidth reduction also increased the amount of nonlinear distortion, when compared to a standard mono recording. Additionally, although the dual channels are separated physically on the tape strip, due to the close proximity of the playback heads a susceptibility for the two channels to bleed in to each other remained. The prototype used for this recording gave 29 dB of separation between the two channels.[30] An alternate approach that was considered was to synchronise two Magnetophons to record in tandem.[31] This method would bypass the reduction in dynamic range and the other quality compromises that were made. Although a reliable method for synchronising the Magnetophons was not found, this concept was revisited by GDR engineers in the 1960s, as well as Western tape manufacturers during the 1970s and 1980s. Despite the technical limitations of the modified Magnetophon, Lippert saw immediate value in the results:

> Ausgangsexperimente haben gezeigt, daß es grundsätzlich möglich ist, mit der stereophonischen Zweikanalübertragung den räumlich plastischen Eindruck eines Klangbildes zu Übertragen und damit etwas grundsätzlich Neues, über die Möglichkeiten der Einkanalübertragung Hinausgehendes, von großer Auswirkung für ein Hörerlebnis zu schaffen.[32]
>
> Initial experiments have shown that it is fundamentally possible to transmit the spatial plastic impression of a sound image with stereophonic two-channel playback and thus to create something fundamentally new, beyond the possibilities of single-channel transmission, of great impact to a listening experience.

Lippert saw stereo as a medium with potential for high-value recordings and broadcasts, in the same way that prestigious concerts at the time were sometimes recorded optically to 35mm film.[33] The cited characteristics of Lippert's experimental recordings compare

[29] Lippert, 239.
[30] Lippert, 239.
[31] Lippert, 238.
[32] Lippert, 246.
[33] Lippert, 249.

favourably with contemporary gramophone recordings but not with the steady advances tape recording was undergoing in the US. Lippert nonetheless considered the Magnetophon's limitations as readily surpassable mechanical constraints and advocated continuing stereo research and development.[34] Although the GDR's broadcasting apparatus inherited Haus des Rundfunks and its resources after a period of direct Soviet control, Lippert's modified Magnetophon was not a part of stereo developments at Rundfunk DDR. The broadcaster did, however, develop its own tape recorders, beginning with the R28 in 1949.[35] This was followed in 1951 by the portable R26 tape recorder.[36] Twenty of these were made and they were used extensively by roving reporters for Rundfunk DDR. Although these were both mono recorders, when the world's media descended on the Berlin Conference of 1954, Rundfunk DDR believed the R26 still compared well with the best available portable tape recorders.[37] Along with the Agfa Wolfen Filmfabrik, a manufacturer of photographic film as well as magnetic recording tape, the GDR had a magnetic recording capability that was still superior to most countries during the early 1950s. This scenario changed as improved recorders and tape were exported from the US and the GDR's domestic tape recorders and tape stock began to suffer in comparison.

By 1950 several manufacturers in the US were building tape recorders and players. In the mid-50s, magnetic-tape's impressive audio quality and unique ability to play back a limited catalogue of stereo recordings resulted in a miniature stereo boom among hi-fi enthusiasts. In 1959 the president of the AES was happy to hype the format as "the most fundamental advance in sound reproduction since electrical recording came in 1926".[38] In Britain, EMI released its first commercial stereo tape recordings in 1955.[39] In 1957 there were 650 stereo titles released by 39 companies in the US, but even at its peak magnetic tape was not a widespread consumer format.[40] In 1956, 400,000 tape recordings were sold in the US, not all of which would have been in stereo.[41] This paled in comparison alongside the still expanding record disc market. Comprehensive sales data for records didn't begin in the US until the 1970s, but in 1956

[34] Lippert, 246.
[35] Stankoweit, 'Studiotechnik Rundfunk: Band I', 130.
[36] Stankoweit, 72.
[37] Stankoweit, 88.
[38] John Sunier, *The Story Of Stereo* (Gernsback Library, Inc., 1960), 47.
[39] Ryan, *Recording the Beatles*, 92.
[40] Mooney Jr., 'The History of Magnetic Recording', 36.
[41] Mooney Jr., 37.

Billboard estimated that more than four million record players alone were sold.[42] Despite the obvious audio capabilities of magnetic tape, there were technical factors that mitigated against it becoming a widespread consumer format. Chief among these was its relative expense, particularly in comparison with the ready reproducibility of disc formats.[43] As the vinyl record helped contribute to a continuing US record industry boom, a vinyl stereo disc became the desired technological outcome of the US recording industry. However, the format resisted the conversion. The spiral groove of a disc record substantially complicates any attempt to encode parallel groove tracks, as was achieved relatively straightforwardly in the cases of optical film and magnetic tape. Disc formats already had inherent design limitations related to how the interaction between the groove and needle changes as the needle travels between the outer and inner sections of the disc.[44] Experimental stereo disc formats had to deal with the exacerbation of these issues. The development of a stereo vinyl disc thus presented a particular technical challenge. If different companies came up with proprietary solutions, it also had the potential to split the market into rival competing formats again. This had been the case when the LP and 45 were first released, prompting a costly format war. Although several companies devised innovative solutions to these problems, the eventual introduction of a standardised stereo vinyl record was made possible by an uncharacteristic level of cooperation within the record industry.

By 1957 two companies had technical solutions for pressing stereo records: British Decca and Westrex in the US. Both methods worked along a similar principle of using contrasting motions to encode two audio tracks within a single groove. The grooves duplicated on conventional mono gramophone and vinyl records are encoded using lateral movements of the stylus. Thomas Edison's phonographic cylinders conversely used vertical movement in the stylus. Decca's solution for stereo combined both approaches: lateral movement was used to record one channel of audio and vertical movement was used to record the second. Westrex's method encoded both channels using vertical movement but with each channel offset by 45 degrees to the other. Both elegant solutions, either could have been brought to market at a time when record sales were continuing to expand. Decca, who had their solution earliest, were reluctant to precipitate another format war and instead sought the assistance of the Recording

[42] 'Music-Radio: Estimates '56 Disk Sales At Peak $320 Mil Volume', *The Billboard (Archive: 1894-1960); Cincinnati*, 16 March 1957.
[43] Sunier, *The Story Of Stereo*, 79.
[44] Richard Osborne, *Vinyl: A History of the Analogue Record* (Burlington: Ashgate, 2012), 28.

Industry Association of America to seek a consensus.[45] An industry meeting in Zurich in November 1957 was attended by representatives of British Decca, DDG, Electrola, EMI, Philips, Teldec and Telefunken. A later meeting in Indianapolis endorsed their consensus that the Westrex 45-45 method should be adopted as a unified standard. This was ratified by the Electronic Industries Association in January 1958. Although both methods had weaknesses, the Westrex method had the advantage of applying its limitations equally to both channels. By May of 1958, PYE Records in the UK was releasing stereo records and by June, RCA Victor in the US had a catalogue of 55 stereo discs and a line of stereo record players.[46]

The level of industry agreement that surrounded the introduction of vinyl record stereo playback was an unusual example of co-operation across commercial and national lines.[47] Westrex even relinquished its entitlement to be associated with the method, as the RIAA announced it would be known exclusively as the 45-45 method.[48] Although aided by the context of a record industry that was keen to avoid a repeat of the tumultuous introduction of vinyl records, the actual decisions surrounding the adoption of a shared standard were taken by a relatively small group within the record industry's engineering community. Of note is that this process took place within the commercial and engineering communities of the West. In contrast with their West German counterparts, GDR or other Eastern European engineers or record companies were not party to the finalisation of the stereo disc format. As with the vinyl record and other US-created media formats, stereo in the GDR was a de facto Western standard that was imported directly into the GDR audio infrastructure. Stereo vinyl records became the first-mass produced stereo format, while magnetic recording tape retained a role as a dedicated recording medium. While the origins of vinyl records and stereo vinyl records belonged decisively to the West, the retention of a role for recording tape preserved a hint of the German technical contribution. The conventional tape speed established among US manufacturers was 30 inches-per-second (or even fractions of that speed). This speed was not chosen arbitrarily, it was directly inherited from the German progenitor. The Magnetophon ran at 77 centimetres-per-second and 30 inches was the nearest whole integer after the metric to imperial conversion, leaving the Magnetophon's legacy hardcoded into all tape recorders of the era.

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[45] H. E. Roys, 'Reminiscing—The Stereophonic Record', *Journal of the Acoustical Society of America* 77, no. 4 (1985): 1333.
[46] Sunier, *The Story Of Stereo*, 104.
[47] Roys, 'Reminiscing—The Stereophonic Record', 1334.
[48] 'Music-Radio: 45-45 Stereo Disk Seen Industry Pick', *The Billboard (Archive: 1894-1960); Cincinnati*, 27 January 1958.

3.2 FM Broadcasting in the GDR

Stereo recording, records and broadcasting all migrated to Europe during the late 1950s and 1960s, but this technological conversion was preceded by an earlier technological shift during the early 1950s that prompted a similar degree of broad infrastructural reconfiguration. Like magnetic tape, the introduction of frequency modulation (FM) radio was not undertaken primarily with a view towards enabling stereo. Nevertheless, it was an important technological step towards stereo broadcasting and to some extent the FM changeover provided a template for the stereo rollout that took place several years later. This was particularly true for the GDR's recovering radio set manufacturers and Rundfunk DDR's transmission infrastructure. The application of FM radio was heavily politicised in early Cold War Germany. At the root of this were the impracticalities and resulting tensions surrounding the state of radio spectrum management after the War. A problematic feature of the medium wave (MW) radio network as it developed in Europe during the first half of the twentieth century was the limited amount of usable bandwidth. The proliferation of broadcasters during and after the war lead to a highly congested radio spectrum. European radio stations were regularly interfering with each other's broadcasts and the quality and reach of medium wave transmissions was heavily dependant on atmospheric conditions.[49] During the interwar period there were several attempts to regulate international radio airspace, which led to the formation of the International Broadcasting Union (IBU). The IBU conference in Copenhagen in 1948 attempted to deal with the huge climb in transmitters by delineating the national broadcasting rights for medium-wave transmissions across Europe.[50] To dampen fears of "Wellenchaos" ("airwave chaos"), power limits on transmitters were proposed to restrict interference over shared frequencies.[51] As Germany was still being directly administered by the Allied military administrations in 1948, it was not able to represent its own interests at the Copenhagen conference.[52] The four allies did not pursue a joint policy and lobbied separately for frequencies in their own zones.[53] Leading up to the

[49] Andreas Vogel, 'Zum Verlauf von Innovationsprozessen in der Rundfunkgeräteindustrie der BRD und der DDR am Beisspiel der Einführung der UKW-Technik', in *DDR Innovationsverhalten & Entscheidungsstrukturen: Vergleichende Studien zur wirtschaftlichen Entwicklung im geteilten Deutschland 1945-1990* (Berlin: Duncker & Humblot, 1996), 165.
[50] Heather Leigh Gumbert, 'East German Television and the Unmaking of the Socialist Project, 1952–1965' (Ph.D., The University of Texas at Austin, 2007), 35.
[51] Vogel, 'Innovationsverhalten und Entscheidungsstrukturen', 166.
[52] Bernhard Hein, *Die Geschichte der Rundfunkindustrie der DDR*, vol. 1 (Dessau: Funk Verlag Bernhard Hein, 2002), 10.
[53] Gumbert, 'East German Television and the Unmaking of the Socialist Project, 1952–1965', 35.

conference there were seven MW transmitters and a single longwave (LW) transmitter broadcasting from the Eastern Zone.[54] The Minister for Post and Telecommunications of the GDR, Friedrich Burmeister, interpreted the implications of the Copenhagen agreement to be the reduction of broadcasting to just two MW frequencies and the complete loss of LW transmissions.[55] The potential loss of the LW frequency had particular political significance, as it was the GDR's chief means for reaching a broad West German listenership at the time.

The outcomes of the Copenhagen conference were contentious and adherence to its recommendations varied across Europe. FM radio quickly became of interest to European broadcasters as it was not regulated by the terms of the Copenhagen conference and thus offered broadcasters more potential for expansion.[56] FM radio was principally developed in the US during the 1930s by Edwin Armstrong, who was chiefly motivated in his research by its impressive transmission-distance capability.[57] However, FM's intrinsic rejection of static and inter-station interference made it particularly suitable to the broadcasting situation in Europe. The fact that it had audio reproduction characteristics as good or better than any current audio format was more a welcome side-effect than a primary feature. FM radio's ability to reject crosstalk and its conservation of the radio frequency spectrum hastened its acceptance by the Federal Communications Commission in the US, but it was adopted much more rapidly and widely in Europe.[58] FM consequently became a new component in the escalating conflict between the broadcasting networks of East and West Germany. This conflict was manifested in physical terms during the late 1940s and early 1950s by the Western Allies' progressive enforcement of Berlin's political boundaries and the dismantling of broadcasting infrastructure that was nominally in the possession of the GDR but located in West Berlin. This contention of boundaries extended into the airwaves. Non-targeted MW-interference was a feature of European broadcasting, but the GDR made consistent attempts to disrupt West German transmissions into its territory, with Rundfunk im amerikanischen Sektor (RIAS) a particular target.[59] The GDR's jamming policy escalated after June 1952 and there were hundreds of GDR jamming towers by the late 1950s.[60] FM's ability to resist jamming thus became an important

[54] Vogel, 'Innovationsverhalten und Entscheidungsstrukturen', 172.
[55] Vogel, 'Innovationsverhalten und Entscheidungsstrukturen'.
[56] Günter Pipke, *Rundfunk und Politik, kleine Geschichte des Rundfunks in Deutschland*. ([Hanover], 1961), 8.
[57] Gary Lewis Frost, *Early FM Radio: Incremental Technology in Twentieth-Century America* (Baltimore, Md.: Johns Hopkins University Press, 2010), 123.
[58] Frost, 124.
[59] Vogel, 'Innovationsverhalten und Entscheidungsstrukturen', 173.
[60] Nicholas J. Schlosser, 'The Berlin Radio War: Broadcasting in Cold War Berlin and the Shaping of Political Culture in Divided Germany, 1945 - 1961' (University of Maryland, 2008), 296.

part of its value to West German broadcasters as it was rolled out during the 1950s.[61] Similarly, the adoption of FM radio by the GDR was driven in part by the need to match and counter West German broadcaster's new capabilities as the influence wielded over East Germans by broadcasters like RIAS was maintained, despite GDR jamming.[62]

The first FM test transmission in West Germany was in Munich in February 1949, followed by Hannover in March.[63] By August 1950 West German regional broadcasters were beginning to duplicate their MW transmissions on FM wavelengths.[64] The GDR lagged roughly a year behind West Germany in introducing its own FM network.[65] The first FM radio transmission in the GDR was from a 100W transmitter in East Berlin in May 1950. Rundfunk DDR followed this with a 250W transmitter that commenced broadcasting in November 1951.[66] A transmitter in the Harz mountains followed and nationwide coverage was achieved by 1953 with further transmitters in Thuringia and Mecklenburg-Vorpommern.[67] FM was unusual in the context of most post-war technological developments in that the US was not the primary early-adopter, despite originating the technology. FM's particular technical characteristics enhanced its value to European broadcasters and FM coverage in Europe during the 1950s greatly exceeded that in the US. By 1957 FM only 2% of radio advertising in the US was broadcast by FM stations and the format didn't really take off in the US until the 1970s.[68] By contrast, the introduction of stereo recording and records was definitively led by the US.

The introduction of FM radio necessitated that Rundfunk DDR upgrade its transmission network, but FM also required the GDR's electronics manufacturing industry to supply suitable receivers. Much of Germany's pre-war heavy industrial capacity was located in what became West Germany, but the GDR inherited a reasonable distribution of electronics and light manufacturing companies.[69] A radio receiver factory in Dresden was able to recommence production as early as 1946, although total annual production of radio receivers in the GDR

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[61] Schlosser, 297.
[62] Vogel, 'Innovationsverhalten und Entscheidungsstrukturen', 173.
[63] Vogel, 171.
[64] Thomas Gruber, '50 Jahre Bayerischer Rundfunk - Von einem zu fünf Hörfunkprogrammen (1949-1999)', in *Der Ton, das Bild : die Bayern und ihr Rundfunk 1924-1949-1999* (Augsburg: Haus der Bayerischen Geschichte, 1999), 72.
[65] Vogel, 'Innovationsverhalten und Entscheidungsstrukturen', 174.
[66] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 1:11.
[67] Hein, 1:11.
[68] Asa Briggs, *The History of Broadcasting in the United Kingdom. Vol. 2, The Golden Age of Wireless*. (London: Oxford University Press, 1965), 159.
[69] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 1:8.

between 1948 and 1949 was only about 10,000 medium-wave sets of pre-war design.[70] The introduction of FM-receiver designs proceeded relatively smoothly in the early 1950s, although production was vulnerable to supply chain issues.[71] In 1953 600,000 radio receivers were manufactured, of which nearly half had an FM capability.[72] The design of some radio receivers was politicised by the ongoing airwave conflict. Stern-Radio Berlin made several attempts to build Kolibri-model radio sets that were pre-set to receive a limited selection of approved radio stations.[73] This integrated design-limitation had limited success and the Kolibiri was discontinued as GDR broadcasting policy trended towards an acceptance that the total obstruction of Western broadcasting was unfeasible. By 1955 practically all GDR-manufactured radio sets were FM capable and this technological conversion was essentially complete.

Critical to this transition was the GDR's domestic production of vacuum tube valves; two former Telefunken factories (which became a wholly West German company) in Erfurt and Neuhaus am Rennweg were essential contributors to the resurgence of the GDR radio and electronics industry.[74] The manufacture of new valve designs suitable for portable radios began around the same as the FM changeover and GDR valve manufacturers continued to independently miniaturise their valve designs, although not at the same pace as in the West.[75] The relative resilience of the the GDR's electronics industry had wider significance than contributing to the roll out of FM broadcasting. Radio and electronics manufacturing became a significant export industry for the GDR and it was also a large contributor to the propagation of television in Eastern Europe. In the years 1955-1958 the export of radio and TV sets from the GDR increased by 300%.[76] VEB Stern-Radio Staßfurt became one of the largest manufacturers of TVs in Europe; in its first year of production in 1957 it produced over 9,000 sets, by 1964 this had increased to 360,000.[77] The GDR's success in maintaining a capacity to manufacture and improve vacuum tube valves was of enormous significance to this role as electronics supplier. Vacuum tubes were also a foundation that allowed the GDR to transition into the transistor age during the 1960s. Although disparities of quantity, quality and capability

[70] Hein, 1:104; Hein, 1:323.
[71] Vogel, 'Innovationsverhalten und Entscheidungsstrukturen', 181.
[72] Vogel, 183.
[73] Vogel, 173.
[74] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 1:199.
[75] Hein, 1:203.
[76] Hein, 1:321.
[77] Hein, 1:115.

between GDR- and Western-designed electronics components existed from an early stage, the GDR electronics industry was still able to supply a degree of technological independence. This allowed audio industry institutions like Rundfunk DDR to run technical development programs over several decades and to build a recording and broadcasting infrastructure that was largely based on their own designs and GDR-constructed components. It was only during the 1980s, as technology digitised, that the GDR electronics industry began to collide with unsurpassable limits to its research and development abilities. This trajectory is discussed in more detail in the chapter on System 2000, but the roots of that project's potential and its eventual failure can be observed in the GDR's electronics industry of the 1950s and 1960s.

FM was brought to Europe as a continent-wide solution for a more integrated broadcasting system. Largely effective in this regard, it nonetheless played a role in the continued politicisation of radio broadcasting and the use of radio transmissions as a technological front in the Cold War. This was initially characterised by GDR strategies to block Western transmissions while attempting to maintain its own broadcasting reach into West Germany. These broadcasting goals proved to be incompatible and the GDR's navigation of these conflicting impulses eventually led to a technological liberalising of its broadcasting policy; in 1957 the GDR adopted Western European transmission standards.[78] Turning away from a potential path of mutual incompatibility, the introduction of stereo broadcasting in the early 1960s was largely carried out in a more normalised pan-German transmissions context. The technological characteristics of FM radio - which allowed it to resist interference and jamming - was a contributing factor to the acceptance by the GDR that the broadcasting of East and West Germany would exist in parallel. Apart from its broadcasting implications, the introduction of FM was a notable proving ground for a reviving East German electronics industry. Its ability to absorb FM techniques and supply electronics components was significant for the later introduction of stereo and the ability to sustain the technical capabilities of various domestic institutions, including Rundfunk DDR and Deutsche Schallplatten.

[78] Gumbert, 'East German Television and the Unmaking of the Socialist Project, 1952–1965', 52.

3.3 Preparing for Stereo: Deutsche Schallplatten and Rundfunk DDR

FM was a fundamental technological alteration of the radio medium and required a large-scale transformation of the GDR's broadcasting and receiving network. Much like the vinyl disc, FM was an improved medium for audio but neither FM nor vinyl records directly dictated technical upgrades or changes in practice for the recording process. Stereo was arguably a less radical technological upgrade in comparison to FM or vinyl records. Although it required some technical innovations to make it feasible across various media formats, at root it was simply the standardisation of methods for using two channels of audio. However, stereo required much more extensive alterations to the recording process in order to take advantage of its additional properties. The rationalisations used to justify the large-scale investment required by the stereo conversion in the GDR and elsewhere were different in character to those used for the FM conversion a few years previous. In comparison to FM, stereo broadcasting offered the GDR no additional strategic value for broadcasting in terms of reaching a greater proportion of the West German population or eliminating inter-station interference. The introduction of stereo in the GDR was thus less factious than that of FM radio and more emblematic of the broad technological and cultural arms race between East and West that endured after the 1950s. Although both FM and stereo in the GDR were motivated in large part by all-encompassing political directives to match the technological achievements of the West, the justification for stereo was centred largely on its capacity to enhance the cultural value of a recording. This justification was sufficient to prompt the upgrading of the recording infrastructures of the GDR's recording institutions and, subsequently, its broadcasting and record-pressing infrastructures.

There was a recognition within the GDR, expressed explicitly by the acoustician Herbert Buttenberg in 1958, that there was no impetus or framework within the Soviet Union or the wider Eastern Bloc to develop an independent approach to stereo in parallel with developments in the West.[79] The stereo infrastructure that was assembled in the GDR in the early 1960s thus largely emulated internationally-developed standards and had little to do with the various experimental recordings made in Haus des Rundfunks during the 1940s. Following on from ad hoc collaborations that took place during the FM crossover, there was a degree of coordination across the GDR audio industry. However, there was relatively little central

[79] Herbert Buttenberg, 'Stereo - Ein Geschäft?', *Radio Und Fernsehen*, May 1958.

government direction or assistance apart from broad consumer-focussed political directives. A 1959 meeting of a work group focussed on stereo provides a snapshot of the GDR's preparedness for the new format. The meeting included representatives for Rundfunk DDR, Deutsche Schallplatten, the RFZ, the Staatliches Rundfunkkomittee (State Radio Committee) and several other technical and manufacturing audio companies.[80] Two stereo record players were in development by the electronics manufacturer Meßgeräte Zwönitz at the time. Deutsche Schallplatten never considered releasing stereo tape recordings and was reliant on GDR stereo record players coming to market, but the record company considered their cited retail prices (800 DM and 1100 DM) to be out of reach for most customers.[81] Deutsche Schallplatten had an uneasy relationship with GDR manufacturers. In 1958, while embroiled with the fallout from the collapse of the gramophone record market and while trying to initiate a sustainable vinyl record market in the GDR, it was dismayed when Funkwerk Zittau would only commit to producing 2500 vinyl record players that year.[82] The RFZ did not share Deutsche Schallplatten's doubts about GDR manufacturers nor their concerns about price; they considered the overall quality of the players to be the long term priority.[83] Meßgeräte Zwönitz's representatives were encouraged at the meeting to seek collaborators to continue the development of record player motors and stereo pick-ups in an effort to reduce costs, but they were also advised that they would need to rely on their own initiative in realising this.[84]

The overlapping music recording responsibilities of Deutsche Schallplatten and Rundfunk DDR led the two organisations towards some important collaborations during the introduction of stereo recording. They had an existing, if occasionally fractious, collaborative relationship. Perennial tensions tended to be in the area of broadcast royalties and Rundfunk DDR's occasional perceived lack of support for Deutsche Schallplatten recordings; relations were more collegial in the area of recording and recording studios.[85] The efforts of the two

[80] W. Reichardt and Hans-Peter Seifert, 'Protokoll über die vom Arbeitskreis Elektroakustik einberufene Besprechung über Fragen der Stereophonie und der elektronischen Musikinstrumente am 4. Dezember 1959 im Hause des VEB Deutsche Schallplatte Berlin' (Zentraler Arbeitskreis für Forschung und Technik der DDR, 5 January 1960), DR 1/263, BArch.
[81] Reichardt and Seifert, 3.
[82] 'Exposé für Ministerium für allgemeinen Maschinenbau' (Deutsche Schallplatten, 12 September 1957), DR 1/257, BArch.
[83] Reichardt and Seifert, 'Protokoll über die vom Arbeitskreis Elektroakustik einberufene Besprechung über Fragen der Stereophonie und der elektronischen Musikinstrumente am 4. Dezember 1959 im Hause des VEB Deutsche Schallplatte Berlin', 3.
[84] Reichardt and Seifert, 3.
[85] Dr. Rackwitz et al., 'Bericht über eine untersuchung beim VEB Deutsche Schallplatten in der Zeit vom 11.6. bis 24.6.1964' (Ministry for Culture, Economics Department, 10 July 1964), 4, DR 1/266, BArch.

organisations, combined and independent, to secure stereo recording for the GDR warrants comparison as they establish the contrasting methods each used to maintain technological parity with recording developments in the West. During the late 1950s, both organisations prioritised the ability to make stereo recordings in advance of the infrastructures required to distribute stereo recordings to the public. This was motivated by the consideration, expressed by Gerhard Steinke, that "jede unnötige Verzögerung der Einführung verteuert das Archiv" ("each unnecessary delay of the introduction (of stereo) increases the expense of the archive"), articulating a developing view that each monophonic-only recording sessions was a missed opportunity to contributing to the future-proofing of the broadcasters' recorded repertoire.[86] The prioritisation of stereo recording over stereo distribution by Deutsche Schallplatten and Rundfunk DDR was in line with the strategies of record companies in the West like EMI in the UK, although EMI was stockpiling stereo recordings about four to five years before stereo recording began in the GDR.[87]

Deutsche Schallplatten was a regular user of Rundfunk DDR's studio facilities and at times Deutsche Schallplatten was very dependent on this relationship. Rundfunk DDR had a greater capacity for capital investment and had a more stable recording infrastructure, best represented by Funkhaus Berlin. Deutsche Schallplatten, particularly for its large-scale classical recordings, was much more reliant on converted spaces - the Lukaskirche in Dresden was an important example. It had a good acoustic and hosted high-profile recordings, but its availability for sessions was restricted by its continued use for religious services and it required acoustic and technical interventions. Deutsche Schallplatten did have some advantages over Rundfunk DDR. As discussed in Chapter 2, Harri Költzsch, the record company's general director, was able to develop a business model that greatly enabled the procurement of foreign technical equipment. Foreign licensing deals for the Eterna classical music label generated hard currency that allowed it to make direct purchases of western equipment and this quickly became a key component of Deutsche Schallplatten's technical development strategy from around 1957. Licensing income subsidised technical expenditure at Deutsche Schallpatten, but this model also required that this money was continuously reinvested to maintain parity with Western recording standards and to protect the viability of Eterna's classical recordings in the

[86] Gerhard Steinke, 'Technischer Bericht Nr. 308: Der Stand Der Untersuchungen Zur NF-Stereofonie' (Rundfunk und Fernsehtechnisches Zentralamt, 1960), 14, 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.
[87] 'Brit.'s EMI Preps Entry Into Stereo', *Variety (Archive: 1905-2000)*, 29 January 1958, https://search.proquest.com/docview/1032389618?accountid=10673.

Western market. Stereo was the first major technological recording upgrade made by Deutsche Schallplatten, but Költzsch was just starting to escalate this funding model as the company sought to begin stereo upgrading. By collaborating on stereo recordings with Western record companies like Deutsche Grammophon, Deutsche Schallplatten was able to earn money from stereo recordings internationally before it had established its own stereo recording ability.[88] Költzsch directed this income stream towards d the creation of an independent stereo recording capability and the licensing income model continued to fund technical upgrades at Deutsche Schallplatten for the next three decades.[89]

Deutsche Schallplatten's first independent stereo recording trials took place in November 1959 at the company's original headquarters on Taubenstraße, while it was preparing for a move to new premises on Reichstagsufer.[90] It spent more than half a million DM on stereo recording and editing equipment in 1959, more than twice what it spent on renovating its new headquarters and recording studios the same year.[91] Deutsche Schallplatten issued a directive in 1957 for all Eterna recordings to be stereo by 1962 and this was readily achieved.[92] By 1961 most Eterna recordings were already stereo and that year also marked the beginning of stereo Amiga recordings.[93] Of 146 Tanzmusik (dance music) Amiga recordings that year twenty-three were stereo.[94] In 1961 Deutsche Schallplatten also made a significant outlay on record presses and equipment for cutting and electroplating stereo masters.[95] This was part of a general strategy to end Deutsche Schallplatten's continued reliance on the ČSSR-based Artia Prague for pressing vinyl records. Within the context of Deutsche Schallplatten's ongoing difficulties with vinyl record-pressing during this period, stereo contributed further complexities to the vinyl record-pressing narrative explored in more detail in the previous chapter. In 1965 both of Deutsche Schallplatten's most imporatant recording studios, Studio

[88] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959' (Deutsche Schallplatten, 25 February 1960), 6, DR 1/258, BArch.
[89] Harri Költzsch, 'Koproduktion 1961', 21 June 1961, DR 1/260, BArch.
[90] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959', 6.
[91] Költzsch, Harri, 18.
[92] 'Die Entwicklung der Schallplattenindustrie der DDR im 7-Jahrplan #1' (Deutsche Schallplatten, 1957), DR 1/263, BArch.
[93] 'Economisches Jahresbericht 1961' (Deutsche Schallplatten, 1962), 9, DR 135/51, BArch.
[94] Harri Költzsch, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1961' (Deutsche Schallplatten, 26 February 1962), 16, DR 1/260, BArch.
[95] 'Economisches Jahresbericht 1961', 8.

Reichtagsufer and the Lukaskirche in Dresden, were outfitted with additional stereo equipment and the conversion of its existing recording facilities was largely complete.[96]

Deutsche Schallplatten did not purchase all of its studio equipment from the West. It used GDR-designed equipment like Rundfunk DDR's R28 tape recorder during the 1950s and a survey of all of its studios in January 1990 indicates a scattering of GDR audio equipment, including record players, amplifiers, loudspeakers and goniometers.[97] It also constructed several of its own mixing desks during the 1970s and 1980s.[98] However, its overall procurement strategy meant Western recording equipment occupied a progressively larger proportion of the recording framework at Deutsche Schallplatten than that seen at Rundfunk DDR. This was possible due to Deutsche Schallplatten's foreign licensing income, but also the scale of its recording operation. Deutsche Schallplatten slowly expanded from one dedicated recording studio to two dedicated recording studios and three converted churches outfitted for Eterna recordings.[99] The staggered opening of these allowed the record company to spread its investment in equipment over several years and large equipment purchases at any point in its history immediately impacted a significant proportion of its recorded output. Rundfunk DDR had a comparatively broader recording remit and more intense production requirements. While it did purchase equipment from the West, hard currency factors and fluctuating import complications restricted it from accessing this option to the same degree. Rundfunk DDR's long term strategy was much more reliant on the GDR's own capacity to develop and manufacture audio equipment. The Betriebslaboratoriums für Rundfunk und Fernsehen (Radio and Television Laboratory) (BRF) - a technical research group of the Deutsche Post that was closely associated with Rundfunk DDR - was an important contributor to the development of stereo and other technical developments within the GDR's media institutions. Led in the 1950s by Lothar Keibs, the chief acoustician for Funkhaus Berlin, the BRF changed its name in 1961 to the Rundfunk- und Fernsehtechnische Zentralamt (Central Radio and Television Technical Department) (RFZ) der Deutsche Post and for clarity will be referred to by the latter name.[100] In the 1960s the RFZ was heavily involved with the process of converting the recording at Funkhaus Berlin's Block B from mono to stereo. Although the FM conversion had

[96] 'Economisches Jahresbericht 1965' (Deutsche Schallplatten, 1966), 42, DR 135/51, BArch.
[97] 'Aufnahmeeinheiten der Studios von VEB Deutsche Schallplatten' (Deutsche Schallplatten, 29 January 1990), DR 135/57, BArch.
[98] 'Aufnahmeeinheiten der Studios von VEB Deutsche Schallplatten', 5.
[99] 'Aufnahmeeinheiten der Studios von VEB Deutsche Schallplatten'.
[100] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 8.

taken place shortly beforehand, this was the largest single technological shift in recording that was completed at Block B during its use by Rundfunk DDR.

Despite the descent of the Iron Curtain, Rundfunk DDR and the RFZ were able to maintain a consistent engagement with international audio research. One of the earliest proactive actions taken by the RFZ in anticipation of developing a stereo mixing desk was the organisation of a comprehensive literature review in 1959.[101] Members of the RFZ attended audio technology conferences throughout the 1950s as stereo was being formalised and political differences were not an obstacle to obtaining information on stereo developments.[102] Collaboration with West German radio colleagues was also a positive influence on Rundfunk DDR's adoption of stereo. Steinke and Keibs expressed doubts at some stereo recording methods described by the BBC, but their worries were assuaged by research work shared by Telefunken.[103] A tour in October 1960 by Steinke and other members of the RFZ to several regional radio and TV broadcasting centres in West Germany (including Frankfurt/Main, Baden-Baden and Freiburg) was also helpful in establishing their neighbours' progress with the new format.[104] Although this cross border assistance was helpful to the RFZ, it did not compare with the level of audio-technology cooperation that was taking place around the same time between EMI in the UK and Electrola in Cologne. A collaboration between Len Page (EMI) and Peter Burkowitz (RIAS/Electrola) led to the construction of the REDD.17 console in 1958, which was a ground-breaking and influential mixing-desk design.[105] The practical development of stereo at Rundfunk DDR began in earnest with the decision to set up a dedicated stereo laboratory facility in 1959, with the ultimate goal of constructing a stereo mixing desk.[106] Domestic production of stereo equipment began in the same year with the construction of a portable stereo test-device by the RFZ that facilitated playback from multiple stereo sources, intended to help integrate new stereo equipment into Rundfunk DDR's existing systems.[107] These methodical steps were characteristic of the approach adopted by the RFZ

[101] Gerhard Steinke and Lothar Keibs, 'Laborbericht 345/37: Regieanlage für stereofonische Aufnahmetechnik' (Betriebslaboratorium für Rundfunk und Fernsehen Labor 345, 25 June 1959), 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.
[102] Lothar Keibs, Gerhard Steinke, and Horst Nutscher, 'Bericht über die 4. Tonmeistertagung in Detmold vom 22. - 25.10.1957' (Betriebslaboratorium für Rundfunk und Fernsehen, 2 November 1957), Deutches Rundfunk Archiv.
[103] Steinke and Keibs, 'Laborbericht 345/37: Regieanlage für stereofonische Aufnahmetechnik'.
[104] Gerhard Steinke et al., 'Informationsbericht über eine Studienreise' (Betriebslaboratorium für Rundfunk und Fernsehen, 27 December 1960), 3, Deutches Rundfunk Archiv.
[105] Ryan, *Recording the Beatles*, 66.
[106] Steinke and Keibs, 'Laborbericht 345/37: Regieanlage für stereofonische Aufnahmetechnik'.
[107] Steinke, 'Technischer Bericht Nr. 308: Der Stand Der Untersuchungen Zur NF-Stereofonie', 57.

and Rundfunk DDR when faced with technological shifts. Steinke argued that, stereo aside, a complete overhaul of the technological basis for handling audio in the GDR was justified by broad developments in electronics:

Noch bevor die Stereofonie die Studiotechnik beeinflußte, führte der Wunsch nach modernen und vielseitigen, transportablen Regieanlagen zu der in vielen Ländern ziemlich einheitlichen Forderung, Mischpulte hoher Kanalzahl mit Transistorverstärkern und einer Vielzahl an Möglichkeiten zur Tonsignalbearbeitung zu entwickeln.[108]

Even before stereophony influenced studio technology, the desire for modern and versatile portable mixing desks led to a demand, similar in many countries, for developing high-channel mixers with transistorised amplifiers and a variety of audio signal processing capabilities.

Steinke advocated that this overhaul be approached holistically as, he argued, the piecemeal upgrades he had observed in other countries would inevitably lead to future compatibility and reliability issues.[109] While this entailed a much greater research burden, the scale of Rundfunk DDR's technical requirements meant it was considered more cost-effective and more feasible than importing all the equipment it needed. Importing equipment was a feature of the RFZ's stereo adoption efforts plans and in 1959 it attempted to purchase a portable stereo mixing desk from Telefunken in West Berlin, along with five Neumann SM 2 stereo microphones.[110] Although this order resembles Deutsche Schallplatten's approach to technical upgrading, the explicit intention was to use the Telefunken and Neumann equipment as a template from which to reverse-engineer components that could then be built in larger numbers by the RFZ itself.[111] The RFZ's first attempt to acquire a Telefunken stereo mixing desk failed and subsequent attempts to procure western stereo equipment were only partially successful. Despite this, 1960 was a year of important stereo firsts for both Rundfunk DDR and Deutsche Schallplatten.

[108] Gerhard Steinke, 'Neuentwicklungen für die Rundfunksterofonie' (Rundfunk und Fernsehtechnisches Zentralamt, 1965), 3, 31/26/1/5, Deutches Rundfunk Archiv.
[109] Steinke, 3.
[110] Steinke and Keibs, 'Laborbericht 345/37: Regieanlage für stereofonische Aufnahmetechnik', 2.
[111] Steinke and Keibs, 7.

3.4 Stereo in Saal 1, Funkhaus Berlin

The earliest stereo recording trials at Rundfunk DDR took place in Saal 1 of Funkhaus Berlin during April 1960.[112] This was an orchestral session, involving the conductor Adolf Fritz Guhl and the Rundfunk-Sinfonieorchester Berlin: recordings were made of symphonic and chamber-sized ensembles playing a repertoire that included music by Mendelssohn and Handel and also included some vocal pieces. The RFZ's inability to procure a stereo Telefunken mixing desk for the session meant Deutsche Schallplatten supplied the stereo recording equipment for the experimental session; Deustsche Schallplatten had previously succeeded in obtaining a stereo Telefunken mixing desk.[113] This first trial was followed by a commercial session in August for Deutsche Schallplatten using the same equipment and again recorded in Saal 1. The was a recording of Haydn's *Die Schöpfung,* but the performance ensemble is not recorded in Rundfunk DDR's evaluative account of the stereo recording.[114] Although Rundfunk DDR did not secure a desk from Telefunken, this second stereo session at Funkhaus Berlin had technical support from a Telefunken engineer who collaborated with the Deutsche Schallplatten and Rundfunk DDR engineers. Steinke's work with the RFZ's Hörgruppe had led to the introduction of listening standards at Rundfunk DDR and the practices of the visiting sound engineers came under scrutiny. Steinke considered Deutsche Schallplatten's engineer's monitoring levels to be excessive.[115] Steinke was also critical of the high-frequency characteristics of the Telefunken loudspeakers used on the session, considering them to be "hart und schrill" ("harsh and shrill") when playing back stringed instruments.[116] Rundfunk DDR had developed its own loudspeaker, the Z 130. Steinke was previously disappointed by the reception this had received from West German engineers but continued to advocate the Z 130 for use at Rundfunk DDR.[117] Regarding the outcome of the stereo recording, Steinke advocated continued experiments with other manufacturers equipment.[118]

[112] Steinke, 'Technischer Bericht Nr. 308: Der Stand Der Untersuchungen Zur NF-Stereofonie', 43.
[113] Steinke, 43.
[114] Steinke, 44.
[115] Steinke, 47.
[116] Steinke, 47.
[117] Gerhard Steinke, 'Abschclussbericht: Bericht über eine Studienreise nach Köln' (Betriebslaboratorium für Rundfunk und Fernsehen, 1957), 31/26/2/4, Deutches Rundfunk Archiv.
[118] Steinke, 'Technischer Bericht Nr. 308: Der Stand Der Untersuchungen Zur NF-Stereofonie', 47.

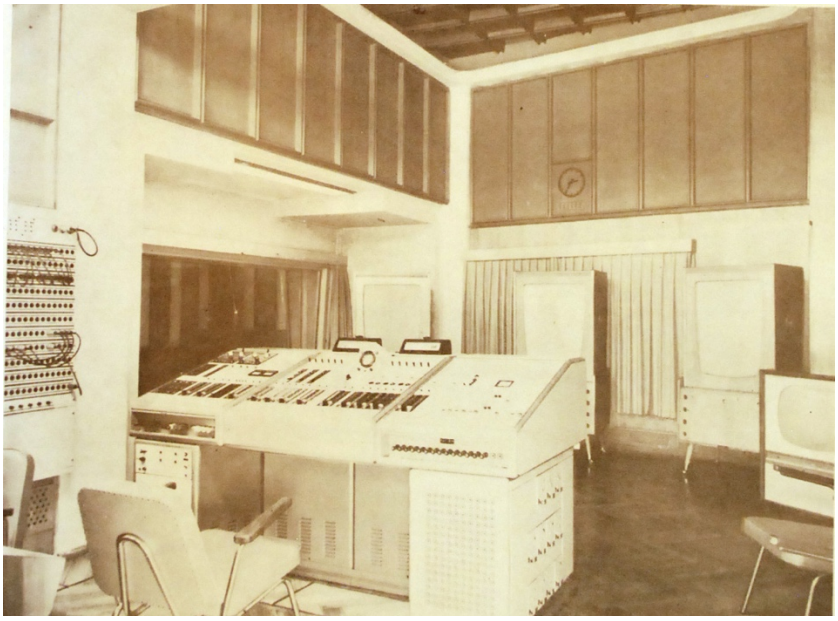

Figure 3.2: The Mehrkanalsversuchregie (MKR) desk installed in Mehrkanalregie 1 (Multi-channel Control Room 1) at Funkhaus Berlin, formerly Abhörraum 1 (Playback Room 1). The window to the left of the desk overlooks Saal 1 but the desk could also record sessions in Saal 2.[119]

The RFZ continued its attempts to import Rundfunk DDR's first stereo mixing desk, but by September 1960 it had accepted these attempts were "aussichtlos" ("hopeless").[120] The RFZ finally sidestepped the difficulties that accompanied importing a complete mixing desk from West Germany by instead importing some critical components but largely constructing the desk itself. The resulting desk was called the Mehrkanalsversuchregie (Multi-Channel Mixing Desk Prototype) (MKR). In March 1963 it was installed - as shown in Figure 3.2 - in a control room adjacent to the existing mono recording control rooms for Saal 1 and Saal 2 at Funkhaus Berlin.[121] The desk itself was valve-based and featured twelve-channels with insert points before and after both the microphone preamp and the desk fader. The desk's specification also included two headphone outputs, stereo voltage units and a goniometer for measuring stereo phase relationships. For monitoring the desk used three of Rundfunk DDR's Z 130 speakers, two for stereo use and one for mono.[122] Steinke's experience from the stereo recording trials with Deutsche Schallplatten's Telefunken desk, along with his knowledge of the prevailing academic stereo discourse, led him to believe that it was not enough to simply

[119] Gerhard Steinke, Wolfgang Hoeg, and M. Wasner, 'Einrichtung eines Experimental-Regieraumes für Mehrkanal-Aufnahmetechnik im Funkhaus Berlin Oberschöneweide', *RFZ Information*, September 1963, 31/26/1/3 - 31/26/1/6, Deutches Rundfunk Archiv.
[120] Steinke, 'Technischer Bericht Nr. 308: Der Stand Der Untersuchungen Zur NF-Stereofonie', 56.
[121] Steinke and Hoeg, 'Mehrkanalübertragung im Rundfunk: Rückblick und Ausblick aus Anlaß der Betriebseinführung der Stereofonie im Rundfunk der DDR vor 10 Jahren', 76.
[122] Gerhard Steinke and Klaus Wagner, 'Experimentalprogram für stereofone Aufnahmetechnik 1964' (Rundfunk und Fernsehtechnisches Zentralamt, 1963), 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.

construct a multi-channel desk with a basic provision for stereo recording.[123] While there was a relatively high level of international consensus surrounding stereo transmission and stereo record standards, stereo recording was not codified to the same degree. Although many soon-to-be conventional stereo recording approaches had been devised by Blumlein and others in the 1930s, there was still a degree of uncertainty around stereo-recording's final form and also the interaction between heritage mono recordings and the new format. The MKR thus emphasised flexibility and was a stereo-research resource as well as an active recording desk. These attributes allowed the RFZ to publicise the MKR internally as superior to any standardised stereo-mixing desk it might have acquired from Telefunken.[124] The additional features allowed the RFZ to experiment with both established and more esoteric recording techniques, as well as devising inter-compatibility tactics for mono and stereo recordings; a serious concern for engineers during the stereo crossover period. The stereo crossover in the record industry was greatly eased by the ability of heritage mono record players to play stereo vinyl discs without any technical intervention. In the recording world, stereo recording techniques that provided an excellent stereo image but which could collapse to a coherent mono signal were a comforting tool to a generation of engineers reared in a strictly monophonic world. These techniques remained relevant for a significant period of time after stereo became the de facto standard.

As well as backward compatibility stereo-to-mono concerns, another feature of Rundfunk DDR's stereophonic research efforts was the serious attention given to converting mono records into stereo-simulacra. Sometimes referred to as pseudo-stereophony, manipulating monophonic recordings to emulate a stereophonic effect has a history nearly as old as "true" stereo. In 1925 the German audio engineer Heinrich Kluth proposed a method for creating the impression of "plastic listening" from a single-channel source.[125] Kluth's method was just one of a multitude of proposed pseudo-stereophonic methods that varied widely in their sophistication and viability. Pseudo-stereophony was an attractive proposition for radio broadcasters as, for a time, it seemed to offered the potential of creating stereo broadcasting by altering the radio receiver and leaving the existing recording and broadcasting infrastructure largely intact. This became less relevant as FM-multiplexing became the progressive medium

[123] Steinke and Wagner, 107.
[124] Steinke, Hoeg, and Wasner, 'Einrichtung eines Experimental-Regieraumes für Mehrkanal-Aufnahmetechnik im Funkhaus Berlin Oberschöneweide'.
[125] Alfred Gradenwitz, 'Plastic Radio by the Kluth System', *Radio News*, 10 October 1925, americanradiohistory.com.

for radio during the 1950s, but pseudo-stereophony was still considered relevant as a method for presenting archival recordings. The RFZ's Lothar Keibs had some success with a process that used filters and delay to produce a pseudo-stereophonic effect; this was still being used to prepare archival mono recordings for stereo broadcast as late as 1967.[126] The Cologne-based record company Electrola developed and marketed a similar process to record labels and there were releases by labels like RCA and Deutsche Grammophon that were stereo-enhanced mono recordings.[127] There were also efforts made in the US to refresh notable mono recordings. RCA Victor applied a process called Electronic Stereo Reprocessing to recordings of Arturo Toscanini in 1961.[128] An independent proprietary method known as the "Magic Dimension" technique was of interest to Rundfunk DDR during the early 1960s, but communication between Rundfunk DDR and the Hamburg-based record company Teldec on their experiences with the format helped to confirm the GDR broadcaster's doubts.[129]

While pseudo-stereophony techniques became increasingly peripheral as stereo recording stabilised and the repertoire of recorded stereo works expanded, the broad flexibility of the MKR helped Rundfunk DDR to weather a period of technological uncertainty.[130] A willingness to engage with esoteric recording methods remained a characteristic of the GDR's recording institutions, although none of these became as ubiquitous as stereo. In 1971 Deutsche Schallplatten equipped the Lukaskirche in Dresden with a full quadrophonic recording set-up, during the period when the format was briefly popular for classical recordings.[131] Around the same time, Rundfunk DDR was an enthusiastic adopter and promoter of binaural recording – known as Kopfkunst in German-speaking countries; a recording approach that used stereo's conventional two-tracks to deliver a stereo representation with emphasised spatialisation to listeners using headphones.[132] Alternative conceptualisations of stereo were also significant in

[126] Klaus Wagner, 'RFZ Mitteilungen Informationen: Zum gegenwärtigen Stand der stereofonen Aufnahme- und Übertragungstechnik für Musik' (Rundfunk und Fernsehtechnisches Zentralamt, May 1967), 9, 13, 31/26/1/5, Deutches Rundfunk Archiv.
[127] Wagner, 14.
[128] Eric Barry, 'Mono in the Stereo Age', in Living Stereo : Histories and Cultures of Multichannel Sound (New York, NY ; London: Bloomsbury Academic, 2015), 134; Jack Arthur Somer, 'Toscanini in Stereo: Through Techniques of "Electronic Reprocessing," the Maestro Can Now Be Heard on Two Channels.', High Fidelity, March 1961, americanradiohistory.com.
[129] Wagner, 'RFZ Mitteilungen Informationen: Zum gegenwärtigen Stand der stereofonen Aufnahme- und Übertragungstechnik für Musik', 8.
[130] Steinke and Wagner, 'Experimentalprogram für stereofone Aufnahmetechnik 1964'.
[131] Harri Költzsch and Heinz Neitzert, 'Jahresanalyse 1971' (Deutsche Schallplatten, 23 February 1972), 14, DR 135/52, BArch.
[132] Gerhard Steinke, 'Zur Frage der Kompatibilität zwischen kopfbezogener und raumbezongener Stereofonie' (OIRT Rundfunk und Fernsehen, 1976).

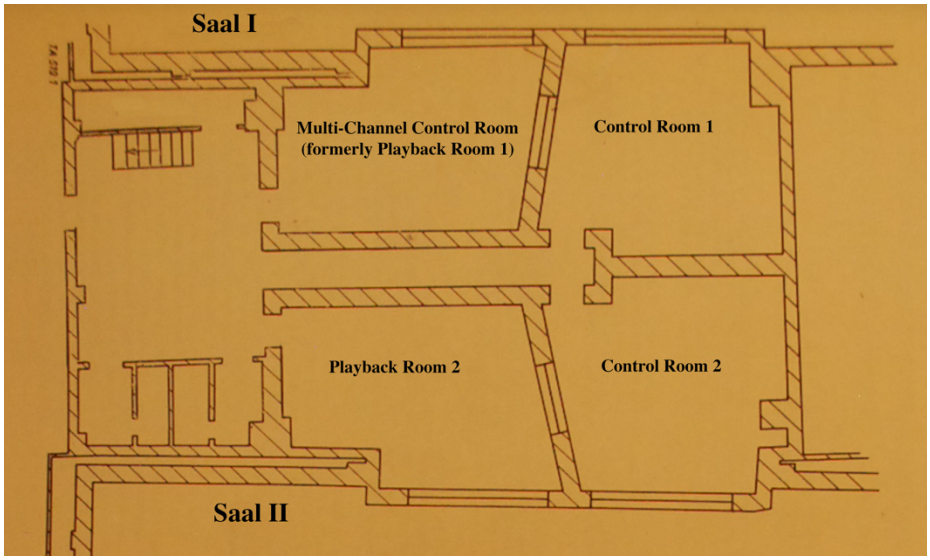

Figure 3.3: Layout and functions of the control spaces shared between Saal 1 and Saal 2 after 1960. The option to expand technical control facilities into a playback room eased the transition to stereo and the proximity of the new control space to Saal 2 enhanced the value of Block B's first stereo recording facility. [133]

the development of a proprietary sound reinforcement by the RFZ in the 1970s, used to outfit the Palast der Republik in East Berlin and discussed at length in Chapter 4.

The MKR stereo recording desk had lasting implications for the layout of recording at Funkhaus Berlin. The desk's installation prompted a significant reorganisation of the control rooms for Saal 1 and Saal 2, beginning a process of deviation from the architect Franz Ehrlich's original intentions for these spaces, previously alluded to in Chapter 1. The original layout of the control rooms for Saal 1 and Saal 2, which are situated in an acoustically isolated void between the two recording spaces, allowed each space a dedicated control room alongside a playback room for non-technical production staff. The exigencies of stereo led to a reprioritisation of the use of these rooms and the new stereo desk was installed in what was formerly the playback room - Abhörraum 1 - for Saal 1; this new arrangement is depicted in Figure 3.3.[134] This left the existing mono control room intact and operational and the MKR desk's location was re-termed the Mehrkanalregie 1 (Multi-Channel Control Room 1). The former playback room was originally intended to allow artistic personnel a space to evaluate recordings without entering the utility-focussed control room, but the acoustic and physical features of the room were very similar to the control room. The playback room had a line-of-

[133] Steinke, Hoeg, and Wasner, 'Einrichtung eines Experimental-Regieraumes für Mehrkanal-Aufnahmetechnik im Funkhaus Berlin Oberschöneweide'.
[134] Steinke, 'Technischer Bericht Nr. 308: Der Stand Der Untersuchungen Zur NF-Stereofonie', 52.

sight window into Saal 1 and it could also be patched into Saal 2. When the stereo control room came into service in 1963, it served in parallel with the existing mono control room, Regieraum 1. This allowed Rundfunk DDR to methodically develop its stereo recording practice and build a stereo repertoire without interrupting or interfering with normal production.[135] This practice was influenced by communications with West German colleagues that suggested running stereo and mono recordings in tandem to ensure the creation of a mono-compatible recording, as mono continued as the dominant transmission format during the early 1960s.[136] The residual supremacy of the older format was further demonstrated by assigning the mono-Tonmeister overall responsibility for the recording session during the period when mono and stereo recordings were run in parallel at Funkhaus Berlin.[137] The renovation of a playback room into an additional control room disrupted Franz Ehrlich's original delineation of space and his separation of artistic and technical audio assessment roles. However, the additional space the incorporation of playback rooms in his design provided proved invaluable to ongoing upgrading processes for Saal 1 and Saal 2. This additional availability of independently-isolated acoustic spaces allowed Rundfunk DDR to install upgraded control room facilities, while allowing the current control room to operate uninterrupted. In 1974, Saal 2 was upgraded to Rundfunk DDR's proprietary transistorised audio equipment and Playback Room 2 became the new control room.[138] The former control room for Saal 2 then became a supplementary recording and editing room for Saal 1.[139] This enhanced flexibility for major upgrades prompted Steinke to suggest that all future music studios should be designed with two separate control rooms and an additional playback room.[140] The unlikelihood of a studio building project incorporating this amount of semi-redundant space into its design emphasises the value of the additional specialised practical space Rundfunk DDR did have.

3.5 Diversifying Stereo in Block B

[135] Steinke and Wagner, 'Experimentalprogram für stereofone Aufnahmetechnik 1964', 116.
[136] Steinke, Gerhard, 'Grundsätzliche Überlegungen für einen Einheitsregieraum für Einkanal- und Stereo-Aufnahmetechnik' (Betriebslaboratorium für Rundfunk und Fernsehen, 8 June 1959), 1, Deutches Rundfunk Archiv.
[137] Steinke and Wagner, 'Experimentalprogram für stereofone Aufnahmetechnik 1964'.
[138] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 104.
[139] Steinke and Herzog, 104.
[140] Steinke, Gerhard, 'Grundsätzliche Überlegungen für einen Einheitsregieraum für Einkanal- und Stereo-Aufnahmetechnik'.

Deutsche Schallplatten's procurement policies for recording and record pressing equipment and how they were applied to different genres of music offer insight into how it interpreted the role of different types of music within its cultural and commercial remit, and how this changed over time. Classical music and the classical label Eterna were heavily prioritised in technical expenditure due to Deutsche Schallplatten's reliance on the foreign licensing fees Eterna's prestige recordings could attract. This prioritisation overlooked the fact that Deutsche Schallplatten's domestic record sales were heavily dominated by the popular music offerings of the Amiga label. This dynamic shifted somewhat during the mid-1960s and into the 1970s as the success of several Amiga artists moved Deutsche Schallplatten to recognise the cultural value GDR popular music artists had abroad. The application of stereo at Funkhaus Berlin to genres other than classical does not offer a similarly systematic analysis of how Rundfunk DDR allocated resources by genre, but it does offer a snapshot of how it treated the diversification of stereo during a specific technological moment.

As at Deutsche Schallplatten, classical music benefitted in terms of technical resources from its position of prestige within the cultural hierarchy of the GDR. Three of the four music recording spaces at Funkhaus Berlin were specialised towards different forms of classical music and the MKR was positioned to augment two of these. However, during the period before Rundfunk DDR was able to secure additional stereo equipment for Funkhaus Berlin, the broadcaster sought to use the capabilities of the MKR as broadly as possible. This diversification process began in October 1963 with the first non-classical stereo recording at Funkhaus Berlin.[141] This was a two-day session with the Tanzorchester des Berliner Rundfunks in Saal 2 overseen and reported on by Gerhard Steinke and Klaus Wagner. The session also marked an early opportunity for Rundfunk DDR engineers to hear a stereo representation of Saal 2, as Saal 1 was prioritised in early stereo sessions. The tentative goal of the session was to devise an instrumental layout suitable to the space and ensemble within the context of a stereo recording.[142] This was not an entirely straightforward task for the Rundfunk DDR engineers who, unlike the early Saal 1 stereo trials, were working without the assistance of personnel experienced with stereo recording. Recording practices for popular music had long diverged from classical music approaches and the report from the Saal 2 trial discusses the session in this context. Steinke described classical music recording practice as the attempt to

[141] Gerhard Steinke and Klaus Wagner, 'Stereo-Versuchsaufnahmen mit dem Tanzorchester des Berliner Rundfunks' (Rundfunk und Fernsehtechnisches Zentralamt, 1963), 31/26/2/4, Deutches Rundfunk Archiv.
[142] Steinke and Wagner.

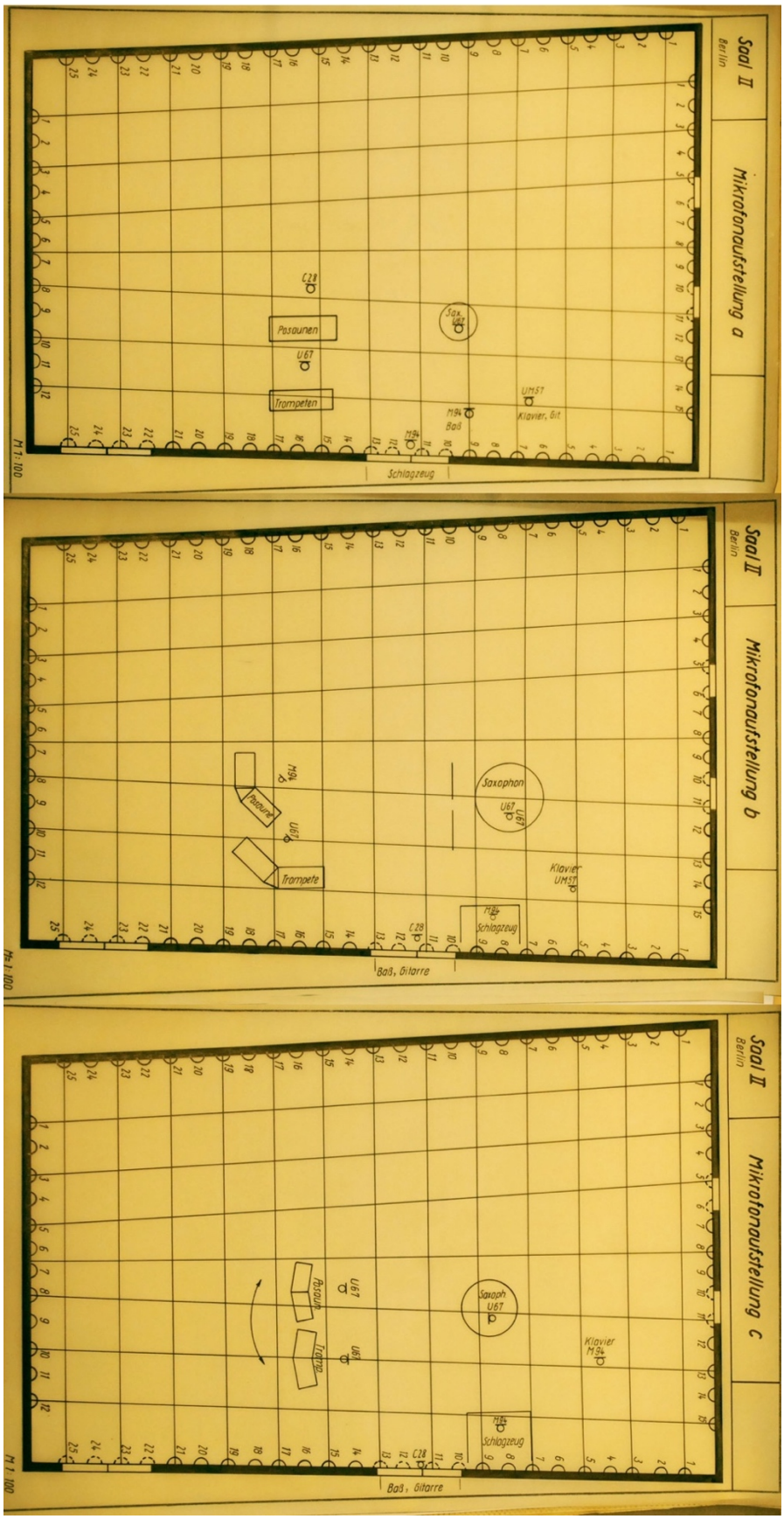

Figure 3.4: Three instrumental layouts used for an experimental stereo session in Saal 2, October 1963. The session shows the RFZ used similarly rigorous procedures across different genres to assess best practice.[143]

[143] Steinke and Wagner.

create an emulation of the acoustic image as it would be experienced by a listener seated in an idealised location within the performance space.[144] By contrast, popular music recording practice during the mono-era was characterised as having developed into the seeking of a bespoke tonal balance that best served the particular arrangement.[145] The application of stereo technology to recording sessions was thus not just a question of technology and the reconciliation of a popular music recording aesthetic with the new format was treated as a task independent of the development of classical music stereo recording practice.

Rundfunk DDR's first attempt at a stereo popular music recording adopted a rigorous approach; the session made three separate recordings of two pieces with an ensemble consisting of: drums, bass, guitar, piano, saxophone, trombone and trumpet. The recorded pieces were Duke Ellington's *Satin Doll* and Billy Moore's *Marchmellow Hare*.[146] Moore was an American arranger who lived in Berlin during the early 1960s.[147] The choice of pieces is somewhat striking given the GDR's fluctuating official regard for jazz, but jazz-influenced ensembles were a significant constituent of popular music in the GDR.[148] The main technical concern of the session was ensuring separation between the different instrument groupings and a number of different ensemble layouts were attempted over the course of the two days, as relayed in Figure 3.4.[149] Achieving isolation between the various instrument groups proved problematic and the various layouts trialled varied quite drastically, with several instruments stationed in the hallway outside the recording space (though supplied with a headphone mix) in the final permutation.[150] The success of each instrumental layout was determined using a methodical approach; sound level measurements were taken at each microphone for each layout and a separate reading made for the bleed from each instrument.[151] While experimental recording sessions often incorporate comparisons of various microphone types, the explicit goal of this session was to address the issue of separation and the same microphones were used for each instrumental layout. These included Neumann U 67s (West German), AKG C 28s (Austrian)

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[144] Wagner, 'RFZ Mitteilungen Informationen: Zum gegenwärtigen Stand der stereofonen Aufnahme- und Übertragungstechnik für Musik', 2.
[145] Steinke and Wagner, 'Stereo-Versuchsaufnahmen mit dem Tanzorchester des Berliner Rundfunks'.
[146] Steinke and Wagner, 'Stereo-Versuchsaufnahmen mit dem Tanzorchester des Berliner Rundfunks', 3, 4.
[147] 'Moore, Billy', in *Grove Music Online* (Oxford University Press, 2003), http:////www.oxfordmusiconline.com/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-2000309500.
[148] Hazel Guild, 'E. Germany Again Switches Off Jazz; Even U.S. Protest Singers Get Axe', *Variety (Archive: 1905-2000)*, 10 May 1967, https://search.proquest.com/docview/1017147358?accountid=10673.
[149] Steinke and Wagner, 'Stereo-Versuchsaufnahmen mit dem Tanzorchester des Berliner Rundfunks', 1.
[150] Steinke and Wagner, 3.
[151] Steinke and Wagner, Tabelle 1.

and Neumann UM 57s (East German). The notes on the recording session do not indicate whether the results of the session were ever broadcast, although Steinke and Wagner were satisfied enough with their final recordings to allow them to be submitted to an international stereo study group for analysis.[152] Regardless, the session's value was primarily procedural and in how it broadened the genre application of stereo within Rundfunk DDR. Although trial recordings with new equipment are not exceptional within the context of any broadcaster or record company, the analytic procedures applied by Steinke and Wagner to the Saal 2 stereo recording exhibit a meticulousness identical to that used by Rundfunk DDR to establish procedures for large-scale classical recordings. The recording is also notable for taking place within months of the activation of the MKR. By comparison, there were several years between the first Eterna stereo recording and the first Amiga stereo recording.

Stereo recordings at Rundfunk DDR further exposed the recognised technical limitations of the broadcaster's R 29 tape recorders in comparison with Western tape recorders.[153] Rundfunk DDR was successful in maintaining a magnetic tape recording capability with its own tape recorder models during the 1940s and 1950s and stereo-augmented versions of the R 29 tape recorder were the basis for many of its early stereo recordings.[154] As Deutsche Schallplatten increasingly relied on imported tape recorders, Rundfunk DDR continued to update its tape recorders and in 1963 started to convert them to international tape-speed standards.[155] This was a telling example of the increasing technological hegemony of US recording standards; these new speed standards were derived from the Magnetophon's original speed conventions after their transfiguration to US Imperial standards in the early 1950s. The technical limitations of GDR tape recorders were augmented by problems with the tape stock used by both Rundfunk DDR and Deutsche Schallplatten. The pre-war German photographic film manufacturer Agfa had post-war remnants on either side of German border: Agfa Wolfen in the GDR and Agfa Leverkusen in West Germany, both of which became significant sources of magnetic recording tape for international recording companies. Tape made by Agfa Wolfen, primarily Agfa Typ-C tape, was commonplace within the GDR audio industry and Eastern Bloc recording companies and broadcasters.[156] However, by the mid-1950s, the magnetic tape

[152] Steinke and Wagner, 8.
[153] Steinke and Wagner, 6.
[154] Steinke and Wagner, 6.
[155] Stankoweit, 'Studiotechnik Rundfunk: Band I', 102.
[156] Steinicke, 'Reisebericht des Kollegen Steinicke für die Zeit vom 8. - 9. 4. 1960 in die VR Bulgarien' (Deutsche Schallplatten, 19 April 1960), DR 1/260, BArch.

heritage shared between East and West Germany was diverging and there was an expanding quality disparity between the tape stocks produced by the two Agfa counterparts.[157] Deutsche Schallplatten and Rundfunk DDR were almost totally reliant on Agfa Wolfen tape stock during the 1950s, but from about 1956 Deutsche Schallplatten, in particular, became increasingly dissatisfied with the standard of results using Agfa Wolfen's Typ-C tape.[158] The short-comings of the tape stock had implications for the quality of Eterna recordings made without the assistance of Western record companies and threatened the licensing potential of these recordings. This led to a change of policy regarding tape procurement and Deutsche Schallplatten began to investigate the possibility of importing various brands of Western recording tape manufacturers including BASF, 3M and Agfa Leverkusen. It wasn't until 1959 that the record company was able to secure a supply of Agfa Leverkusen's PE 22-type tape, but it could not obtain enough to cover all its recording needs and the tape was applied preferentially to Eterna recordings.[159] One of the definitive analytical outcomes of the experimental stereo sessions held in Saal1 for both Deutsche Schallplatten and Rundfunk DDR was an enhanced recognition of the contribution of tape quality to the final recording and criticism of Agfa Wolfen's tape was consequently renewed.[160] Deutsche Schallplatten could secure Western recording tape in high enough quantities to secure its highest priority recordings, but Amiga and general Rundfunk DDR production continued to rely on Agfa Wolfen tape stock into the 1960s and 1970s.[161] Despite the low professional regard Agfa Wolfen tape held within Deutsche Schallplatten and Rundfunk DDR, it was crucial to both organisations. Given that magnetic tape was never a consumer format in the GDR, it may also have retained some aura of technological prestige as a specialised tool of the GDR's recording institutions. This may account for the prominent placement Agfa Wolfen tape reels were regularly accorded within promotional photos for Rundfunk DDR during the 1960s, an example of which is given in Figure 3.5.

[157] Steinke, 'Bericht über eine Studienreise nach Köln', 10.
[158] 'Ökonomische Jahresanalyse 1957' (Deutsche Schallplatten, n.d.), 7, DR 135/51, BArch.
[159] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959', 11.
[160] Steinke, 'Technischer Bericht Nr. 308: Der Stand Der Untersuchungen Zur NF-Stereofonie'.
[161] Költzsch, Harri, 'Geschäftsbericht (mit Erläuterungen zum Kontrollbericht) für die Zeit vom 1. Januar bis 31. Dezember 1959', 11.

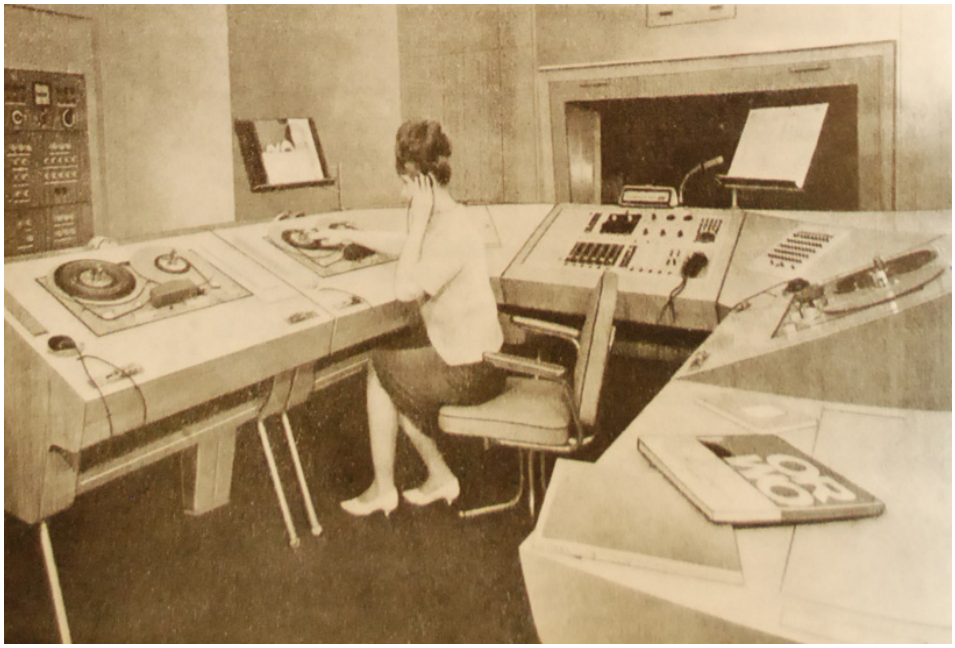

Figure 3.5: A 1967 promotional photograph from Deutsche Post depicting the transmission of pre-recorded programme material from Funkhaus Berlin. The prominent placement of Agfa Wolfen tape (under the Orwo export imprint) in the right foreground emphasises a domestically produced and specialised audio format.[162]

The Saal 2 stereo session was a place-holder experiment, as focussed plans to expand stereo recording at Funkhaus Berlin were already underway.[163] A degree of equity in the distribution of resources according to genre is further indicated by the placement of Funkhaus Berlin's second stereo mixing desk in Saal 4, Block B's primary facility for popular music. Saal 4 was renovated during 1963 and by 1964 it was running a new stereo-capable desk based on Rundfunk DDR's own System 700 technology.[164] Saal 4 did not have the dual control spaces of Saal 1 or Saal 2. Running parallel mono and stereo sessions was thus not seen as appropriate for Saal 4 and the upgraded control room was expected to handle both.[165] Deutsche Schallplatten contributed to configuring the new desk's technical specification, which had 24 channels.[166] The control room was equipped with four R 29 tape recorders, a single Telefunken four-track recorder and three Z 130s for stereo/mono monitoring powered by V 274 amplifiers. The new System 700-based control desk demonstrated Rundfunk DDR's increasing aptitude with designing stereo systems, but also a new proficiency with transistor technology. Unlike

[162] 'Jahresbericht der Deutschen Post' (Deutsche Post, 1967), 363/33/5/2/7, Deutches Rundfunk Archiv.
[163] Steinke, Gerhard and Luft, 'Zur technolgischen Aufgabenstellung für die Änderung von Saal 4 und Umbau der Regieeinrichtung (Funkhaus Berlin-Oberschöneweide)' (Rundfunk und Fernsehtechnisches Zentralamt, 18 January 1962), Deutches Rundfunk Archiv.
[164] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 29.
[165] Steinke, Gerhard and Luft, 'Zur technolgischen Aufgabenstellung für die Änderung von Saal 4 und Umbau der Regieeinrichtung'.
[166] Steinke, Gerhard and Luft, 3.

the MKR, System 700 was almost entirely self-developed within the GDR and represented another major technological departure for Rundfunk DDR. The major limitation with transistor technology innovation at Rundfunk DDR was that it was at a workshop scale, so the supply of parts was slow, limited in number and expensive, but of a high quality.[167]

As with the activation of the MKR, as soon as Rundfunk DDR had additional stereo capacity, it sought to use it as flexibly as possible. In addition to its four music recording spaces, Block B also housed two radio drama complexes. At one point, there was a plan to trial stereo drama recording by connecting the radio drama studios to the MKR desk at the other end of the building.[168] This was amended to running tie-lines and a video feed between one of the radio drama studios to Saal 4 and its new stereo mixing desk in November 1964. The first stereo drama recording to utilise this arrangement was, *Kleine Suite des Wartens* by Roger Richard. This was broadcast by Berliner Welle on December 26th 1964, but this quick turnaround proved unusual as the distribution of stereo broadcasting lagged behind Rundfunk DDR's expanding recording capabilities.[169] It was followed by the broadcasting of *Wieviel Erde braucht der Mensch* by Horst Dannenberg in May 1965 and *Warschauer Ballade* by Dieter Noll, in July 1967. The broadcasting of stereo radio drama works only became somewhat regular in 1968 with five works broadcast, but the capability had been established with the 1964 Christmas recording.[170] By the end of 1964 there were a total of five stereo-enabled spaces available to Rundfunk DDR, three of which were capable of making stereo recordings. Four of these were onsite at Funkhaus Berlin: Mehrkanalregie 1, the adjacent Abhörraum 2, the control room for Saal 4 and the RFZ's own playback test-facility.[171] There was also a temporary control room set up at the Sporthalle on Karl-Marx-Allee. These recording spaces secured Rundfunk DDR's ability to record music in stereo and prepared its ability to provide material for the regular stereo broadcasting that commenced shortly after.

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[167] Gerhard Steinke, 'Entwicklung eines transportablen V 600-Stereoregiepultes' (Rundfunk und Fernsehtechnisches Zentralamt, July 1962), 31/26/1/3 - 31/26/1/6, Deutches Rundfunk Archiv.
[168] Gerhard Steinke and Walter Hoeg, 'Stereofone Hörspielproduktion' (Rundfunk und Fernsehtechnisches Zentralamt, 23 February 1965), 1, 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.
[169] "Einige Historische Daten aus der Entwicklung des Stereo-Hörspiele in der DDR" (Rundfunk und Fernsehtechnisches Zentralamt, n.d.), 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.
[170] Myriam Sello-Christian, 'Die Eroberung des Raum-Tones', *Berliner Zeitung*, 27 August 1967, Mehrkanal V.1967, Deutches Rundfunk Archiv.
[171] Gerhard Steinke, 'Zur Stereo-Wiedergabe-Qualität in verschiedenen Regie- bzw. Abhörräumen' (Rundfunk und Fernsehtechnisches Zentralamt, 1964), 31/26/2/4, Deutches Rundfunk Archiv.

3.6 Stereo for the People

The preparations made by Rundfunk DDR and Deutsche Schallplatten to adopt stereo recording were accompanied by the development of the infrastructures to deliver the new format to the GDR public: stereo broadcasting and stereo records. Deutsche Schallplatten's struggles with vinyl record production are depicted in Chapter 2; pressing stereo-compatible records was an additional complicating component to this but it was not a pivotal constraint to the record company's overall vinyl record production efforts. The production of stereo records increased throughout the 1960s and by 1969, 46% of all Deutsche Schallplatten LPs were in stereo.[172] Introducing stereo broadcasting to the GDR was a more complicated process and took longer to reach a mass audience. A consensus on the technical methods for broadcasting in stereo was not reached until the late-1950s and until that point stereo broadcasting was defined by its non-uniformity. Diverse stereo transmission experiments were made during the inter-war period in many countries, mostly using dual-transmission methods with each transmission carrying a single channel of audio. The Reichs Rundfunk Gesellschaft made experimental medium-wave stereo transmissions along these lines in the mid-1920s.[173] These included an opera performance in Berlin in 1924 broadcast by two co-operating independent transmission towers and a similar effort made in Hamburg in 1925.[174] Experiments on similar technological foundations were continued after the Second World War. Broadcasters including Rundfunk DDR and the BBC continued to make experimental dual-transmission medium-wave stereo broadcasts during the 1950s.[175] Dual-transmission methods were also the basis for some regular stereo broadcasting in the US from the mid-1950s and the Newport Jazz Festival in 1958 was broadcast in stereo using a qualitatively mismatched AM-FM dual transmission method.[176] As FM multiplexing - where a single radio transmission contains both stereo audio channels - looked increasingly to become the consensus format for stereo broadcasting, both the BBC and Rundfunk DDR ceased their own experiments during the late 1950s and awaited the international codification of stereo broadcast standards before resuming stereo broadcast

[172] Harri Költzsch and Heinz Neitzert, 'Jahresanalyse 1969' (Deutsche Schallplatten, 3 February 1970), 5, DR 135/52, BArch.
[173] Kapeller, 'Radio Stereophony'.
[174] Steinke and Hoeg, 'Mehrkanalübertragung im Rundfunk: Rückblick und Ausblick aus Anlaß der Betriebseinführung der Stereofonie im Rundfunk der DDR vor 10 Jahren', 75.
[175] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 1:321; 'OIRT Information 1964: 6' (Organisation Internationale de Radiodiffusion et Television, 1964), 12, 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.
[176] Sunier, *The Story Of Stereo*, 138, 141.

trials.[177] Stereo test transmissions on FM frequencies began in East Berlin in June 1961, by December 1962 test transmissions were using the US-derived pulse amplitude modulation FM multiplexing method.[178] Rundfunk DDR largely relied on GDR-created stereo resources for providing the content for these test transmissions. This content ranged from test tones to recordings from the 1960 stereo recording session in Saal I, as well as additional Deutsche Schallplatten recordings not made at Funkhaus Berlin.[179] The experimental basis of these transmissions is confirmed by the degree to which the GDR public could engage with them; Steinke estimated that there were as few as thirty to fifty FM stereo receivers in the GDR during the 1960 to 1961 period.[180]

While their ability to receive stereo was severely restricted during the early 1960s, stereo test transmissions were one of the most visible parts of a technological process that was mostly opaque to GDR citizens.[181] As stereo trials advanced, the new technology was increasingly valorised as a symbolic advancement by GDR media institutions. In 1963 the GDR celebrated the fortieth anniversary of radio broadcasting in Berlin and these commemorations were used as the impetus to broaden stereo broadcast trials that year. Stereo's engagement with the public was formalised with industry demonstrations and press conferences in August and October 1963.[182] The stereo roll-out continued with the first stereo programme transmission on 2 August 1963.[183] The following year another milestone for stereo in the GDR was reached with the commencement of the first regular scheduled stereo test-broadcast on 15 September.[184] Transmitting on the Berliner Welle FM frequency, it ran initially for four weeks for thirty minutes on Tuesday and Thursday evenings.[185] The press conference announcement for the new broadcasts was made at an associated exhibition for stereo, *"Seht, Hier ist Deutschland"*. For two months following the start of broadcasting, additional stereo demonstrations were available to the public as part of the exhibition, reminiscent of the large-

[177] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 1:322; Briggs, *The History of Broadcasting in the United Kingdom. Vol. 2, The Golden Age of Wireless*., 133.
[178] Steinke and Hoeg, 'Mehrkanalübertragung im Rundfunk: Rückblick und Ausblick aus Anlaß der Betriebseinführung der Stereofonie im Rundfunk der DDR vor 10 Jahren', 76.
[179] Steinke, 'Technischer Bericht Nr. 308: Der Stand Der Untersuchungen Zur NF-Stereofonie', 67.
[180] Steinke, 67.
[181] 'Rundfunk-Stereofonie' (Die Deutsche Post, 1968), Mehrkanal V.1968, Deutches Rundfunk Archiv.
[182] 'Rundfunk Feiert 40. Geburtstag', *Neue Zeit*, 31 October 1963, Staatsbibliothek zu Berlin; 'Stereo-Versuchssendung', *Berliner Zeitung*, 8 June 1963, Staatsbibliothek zu Berlin.
[183] Steinke and Hoeg, 'Mehrkanalübertragung im Rundfunk: Rückblick und Ausblick aus Anlaß der Betriebseinführung der Stereofonie im Rundfunk der DDR vor 10 Jahren', 75.
[184] Müller, 'Protokoll Der 5. Arbeitstagung Am 31.8.64' (Forschungsgruppe Rundfunk-Stereofonie-Programme, 1964), 31/26/1/2 - 31/26/1/7, Deutches Rundfunk Archiv.
[185] Müller.

scale radio fairs that announced Germany's strides in radio during the 1920s and 1930s.[186] A press conference was also given at Funkhaus Berlin by Wolfgang Kleinert from the State Radio Committee, promising that stereo content was being prepared and would soon be made available to radio listeners.[187] Part of these preparations entailed Rundfunk DDR and Deutsche Schallplatten cataloguing and collecting all their existing stereo recordings to create a shared resource.[188] The escalation of stereo transmissions was linked with the GDR's fifteenth anniversary celebrations and characterised in the press as a birthday gift from the GDR to its citizens.[189] This was established rhetoric by GDR media to underline technical achievements of GDR industry, previously applied to a new transistor radio set model released on the GDR's tenth birthday in 1959.[190] Regional stereo broadcasting in the GDR began in Leipzig in 1965. Regular transmissions from Leipzig commenced in 1966 and Dresden followed the following year.[191] By 1968 four million East German households could receive at least one stereo GDR programme (offering 30 hours per week) and a majority of the population could receive two out of the four active programmes.[192] Listeners in Berlin in 1966 had the choice of three stations, giving a total of 90 hours of stereophonic transmission a week, up from a single hour in 1964.[193] In 1968 "Stereo Week" saw Rundfunk DDR collaborate with the state television broadcaster to bring stereo to television. This was achieved with a simulcast of the regular GDR documentary *Aus Wissenschaft und Technik*; those willing to line up a stereo radio set with their television were given a glimpse of a stereo-televisual future.[194] However, Rundfunk DDR's extending stereo broadcast network may not have been initially accompanied by a comparative increase in listeners. In 1968, Steinke estimated that were not much more than 10,000 stereo receivers across the GDR.[195] Radio listenership had been impacted by the uptake

[186] Müller, 2.
[187] „Stereofonie - Klang der Zukunft", *Neue Zeit*, 15. September 1964.
[188] Müller, 'Protokoll Der 5. Arbeitstagung Am 31.8.64', 66.
[189] Erb., 'Stereofonie - Klang der Zukunft'.
[190] -be, 'Ilona und ihr neuer Freund sind eine Freude: Transistor-"Sternchen" ist der große Schlager der Rundfunk-Schau', *Neue Zeit*, 3 September 1959, 205 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2612273X-19590903-0-3-0-0, ZEFYS.
[191] Gerhard Steinke, Wolfgang Hoeg, and M. Wasner, 'Technischer Bericht Nr. 1969 /BP 9-3443/ 8: Stereo-Betriebstechnik II' (Rundfunk und Fernsehtechnisches Zentralamt, 1969), 6, 31/26/1/3 - 31/26/1/6, Deutches Rundfunk Archiv.
[192] Steinke and Hoeg, 'Mehrkanalübertragung im Rundfunk: Rückblick und Ausblick aus Anlaß der Betriebseinführung der Stereofonie im Rundfunk der DDR vor 10 Jahren'.
[193] B.S., 'Mit "Antonio" stereofon', *Berliner Zeitung*, 3 October 1966, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19660310-0-3-57-0, ZEFYS.
[194] 'Einmalig in der Stereo-Woche', *Neue Zeit*, 18 January 1968, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2612273X-19680118-0-2-31-0, ZEFYS.
[195] Gerhard Steinke, 'Rundfunk Journal: Viereinhalb Jahre Rundfunkstereofonie in der DDR' (Rundfunk und Fernsehtechnisches Zentralamt, 1968), Mehrkanal V.1968, Deutches Rundfunk Archiv.

in television ownership during the 1960s, but stereo and improved GDR transistor radios did combine to promote a resurgence of radio set production during 1969 and 1970.[196]

The RFZ and Rundfunk DDR also played a role at the consumer end of the introduction of stereo in the GDR. Gerhard Steinke and other members of Rundfunk DDR and the RFZ were portrayed as important figures of counsel in the media and were used to help address issues of concern for listeners intimidated by the new technology.[197] Steinke was described as "Pionier der Stereofonie in der DDR" ("pioneer of stereo in the GDR") and the RFZ's research work was cited as one of the GDR's main hopes for keeping up with consumer technology developments.[198] In 1963 Steinke published an article geared towards home stereo users in the *Radio und Fernsehen* magazine.[199] Steinke went into considerable detail describing the ideal spacing and layout to experience stereo; every home was different and Steinke encouraged experimentation to reveal the best positioning for an optimal stereophonic sound. He also weighed in on the then-contentious international hi-fi debate by defining hi-fi as studio quality equipment designed for smaller domestic rooms.[200] A definite advocate of stereo in the home, which he described as "ein entscheidener Schritt zur Verbesserung der Wiedergabequalität in Heim" ("a decisive step in the improvement of home playback"), Steinke was not puritanical in his advocacy of the pursuit of good sound in the home, delineating three sufficient levels of quality of varying degrees of affordability.[201] Each of these levels was adequate for enhancing the listener's appreciation of the musicians and composers work, as well as that of the Tonmeister and Toningenieur. Stereo sound became steadily more popular in the GDR and both the regular and specialist printed media covered its roll-out and progress in minute detail. Stereo was firmly established in the GDR by the 1970s and, in line with their reception elsewhere, enthusiasm for the possibilities offered by quadrophony and binaural radio broadcasting among the recording institutions of the GDR did not succeed in displacing stereo from its newly secured position as the high quality audio medium of choice.

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[196] Bernhard Hein, *Die Geschichte der Rundfunkindustrie der DDR*, vol. 2 (Dessau: Funk Verlag Bernhard Hein, 2002), 6.
[197] 'Mit Richtfunk in die gesamte DDR', *Tribune*, 6 March 1965, Mehrkanal V.1967, Deutches Rundfunk Archiv.
[198] 'Eine Kleine Marktinformation: Stereofonie', *Berliner Zeitung*, 6 August 1966, 155 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19660608-0-3-0-0, ZEFYS.
[199] Gerhard Steinke, 'RFZ Information: Stereofonie – ein entscheidender Schritt zur Verbesserung der Wiedergabequalität im Heim' (Rundfunk und Fernsehtechnisches Zentralamt, 1963), 31/26/1/5, Deutches Rundfunk Archiv.
[200] Steinke.
[201] Steinke.

3.7 Conclusion

After many fits and starts, mono records and broadcasting were steadily supplanted globally by stereo iterations from the 1960s onwards. In both the record industry and broadcasting settings, stereo had been preceded by important enabling technologies: magnetic recording tape, vinyl records and FM broadcasting. The GDR had a distinguished technical heritage in the area of magnetic tape recording, but had to scramble to adopt the other enabling technologies. The GDR responded to these technological developments in turn and on a large scale. In each case, GDR manufacturers, publishers and broadcasters became a dominant or highly significant supplier of these new media forms to its citizens. The initiation of stereo recording and broadcasting by the media institutions of the GDR highlights how they were closely engaged with international technical developments and the extent to which they were able to cope with a rapidly-changing technological landscape. Maintaining a demonstrable technological parity with the West remained a consistent political goal of the GDR and the introduction of stereo was a conspicuous way of signalling technological success to its citizenry during the 1960s. Stereo also added momentum to the adoption of transistor technology in GDR consumer electronics and the export of stereo radio sets, stereo recordings and other associated consumer items became important sections of GDR industry.

While the introduction of stereo in the GDR was not exactly aligned with its roll-out in West Germany, stereo was a complicated crossover that entailed a broad range of cross-industry alterations that were not enacted uniformly by any national market or industry. Generally, interactions with West Germany on the topic of stereo, within the confines of travel and import restrictions, were fruitful and there were consistent instances of collegiality between GDR audio engineers and various West German broadcast and record company engineers. Although the airwaves over East and West Germany were particularly contentious during the 1950s prior to the introduction of FM broadcasting, by the time of the stereo broadcasting conversion, this situation was comparatively regularised. Although the stereo paradigm that was delivered to GDR citizens was essentially a derivation of the West's technological example, it was still delivered to a large extent by the GDR's own industriousness. In 1960 Rundfunk DDR was about five years behind the stereo recording capabilities of some Western record

labels, but it laid a methodical groundwork that came to fruition as the international stereo landscape stabilised and GDR manufacturers started to supply suitable record players and radio sets. The RFZ and Rundfunk DDR's systematic approach to the stereo as a technical problem was typical of the two closely-linked organisations. Rundfunk DDR's MKR stereo mixing desk required imported components and depended on dated valve technology, but it was a key marker in the broadcaster's departure from the technological heritage of the RRG that it shared with West German broadcasters. The GDR's increasing transistor production enabled the RFZ to develop its transistor-based System 700 range of audio equipment during the mid- to late-1960s and Rundfunk DDR self-developed most of its critical audio infrastructure for the rest of its lifetime.

Aspects of stereo's introduction the GDR establish illustrative patterns later repeated during subsequent technical developments. Deutsche Schallplatten continued to rely upon its foreign currency income stream to navigate all the recording technology transitions it encountered via direct purchases of relevant equipment. The contrast between Rundfunk DDR's infrastructural development model and Deutsche Schallplatten's direct procurement was maintained into the 1980s, long after most Western broadcasters and record companies had ceased to develop equipment systems in-house. The success of the MKR and System 700 were important precedents that allowed the RFZ and Rundfunk DDR to believe they could self-develop equipment to bridge the next major audio technology step: digital automation and control. The implementation of this technology in the GDR became part of a project called System 2000 during the 1980s. The RFZ's openness towards diverse methodologies was also carried forward. A wariness towards only semi-established international orthodoxy in the field of stereo recording and a willingness to explore esoteric methods had some helpful applications during the 1960s, but it also helped create the circumstances for innovation in later years. In the late 1970s, engineers at the RFZ built on forgotten and anomalous early post-war German stereo research to create a sound reinforcement system for the unique design of the Palast der Republik in East Berlin. Known as Delta Stereo System (DSS), the original concept approached dual-channel stereo using principles distinct from the left-right stereo paradigm that became the orthodoxy. Although the GDR largely accepted and applied Western stereo standards for broadcasting and consumer purposes, it was able to utilise a pre-standardisation concept of stereo as a basis to solve contemporary sound reinforcement problems and to market

this solution internationally. The narratives of both System 2000 and DSS are related in the following chapters.

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Chapter 4:
Delta Stereo and the Great Hall of the Palast der Republik

> Dieser Palast der Republik soll ein Haus des Volkes sein, eine Stätte verantwortungsbewußter Beratungen der höchsten Volksvertretung unseres Arbeiter-und-Bauern-Staates, ein Ort wichtiger Kongresse und internationaler Beratungen. Unsere sozialistische Kultur wird hier ebenso eine Heimstatt finden wie Frohsinn und Geselligkeit der werktätigen Menschen.
>
> This Palace of the Republic shall be a home of the people, a place of responsible deliberations of the supreme representative body of our workers- and labourers-state, a place of important congresses and international discussions. Our socialist culture will find a home here, as well as the cheerfulness and conviviality of the working people.
>
> Erich Honecker at the ground-laying of the Palast der Republik, 2 November 1973.[1]

> Die Akustik wird gut sein, und es wird ein angenehmes Klima herrschen, wofür etwa 200 technische Anlagen das ganze Jahr über sorgen. Die Lautsprecheranlagen in den Sälen entsprechen der Studioqualität des Randfunks.[2]
>
> The acoustics will be good and there will be a pleasant climate, with around 200 technical facilities to maintain year-round. The loudspeaker systems of the venues match the quality of broadcast studios.

In the early 1970s, GDR acousticians and sound technicians were presented with the challenge of designing the acoustics for a large next-generation public auditorium. The Großes Saal (Great Hall) was part of a larger superstructure that was constructed as a major civic centrepiece for East Berlin: the Palast der Republik (Palace of the Republic). The Palast der Republik's ostensible primary function was to host the GDR's national parliament, but its

[1] Alfred Wagner, 'Am Berliner Marx-Engels-Platz entsteht ein Haus des Volkes - ein Palast für uns alle', *Berliner Zeitung*, 9 June 1974, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19740709-0-3-201-0, ZEFYS.
[2] Wagner.

cultural functions would arguably be of greater consequence to East Berlin and GDR citizens. Aside from the Great Hall and the Volkskammer (People's Parliament) plenary hall, the Palast also housed a diverse range of public amenities, from restaurants and bars to bowling alleys and discotheques. These amenities and the Great Hall, completed in 1976, combined to create a vibrant new social and cultural centre in the centre of East Berlin.

The Palast der Republik emerged as a feature of a broad regeneration scheme for East Berlin. The Palast der Republik itself was intended to simultaneously address civic and cultural infrastructural deficits in the city. Its location carried forward resonances from Berlin's pre-war civic administration, but also specific performative aspects of the GDR's political genesis; it was the former site of the Lustgarden public space and the Berliner Stadtschloss (Berlin City Palace) and became a rallying location for Soviet-style parades in the immediate post-war period.[3] These associations became integral to GDR commemorative performance in East Berlin. After the Stadtschloss was demolished in 1950, the location was renamed Marx-Engels-Platz and a stone tribune erected there continued to be a focal-point for May Day Parades until the 1970s.[4] Intended to continue the site's significance in the GDR's political genesis, the construction of the Palast der Republik was given the go-ahead by the SED's central committee in March 1973.[5] The Palast der Republik helped to fill a civic vacuum and, like many other high-profile infrastructural projects in the GDR, it was also able to serve as an indicator for general economic progress across the GDR. Although the imagined redevelopment of central Berlin - of which the Palast der Republik was only a component - did not come to full fruition, Erich Honecker linked its completion to progress with broader infrastructural projects in the GDR, like East Berlin's continuing home-building program.[6] It also showcased the GDR's technical and construction capabilities. Work on the Palast der Republik progressed relatively smoothly; the ground-laying ceremony took place on 4 November 1973 and the targeted completion for the first quarter of 1976 was achieved.[7]

[3] Ines Weizman, 'Palast Der Republik (Palace of the Republic): Designed by HEINZ GRAFFUNDER. Berlin, Germany, 1973–2008', *Journal of Architectural Education* 67, no. 1 (2013): 135–137, https://doi.org/10.1080/10464883.2013.767147.
[4] Weizman.
[5] Wagner, 'Am Berliner Marx-Engels-Platz entsteht ein Haus des Volkes - ein Palast für uns alle'.
[6] Karl-Heinz Arnold, 'Am Marx-Engels-Platz wurde das Haus des Volkes eröffnet', *Berliner Zeitung*, 24 April 1976, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19760424-0-1-7-0, ZEFYS.
[7] Wagner, 'Am Berliner Marx-Engels-Platz entsteht ein Haus des Volkes - ein Palast für uns alle'.

In addition to its political utility the Palast der Republik was a bold reinterpretation of what a parliament house could be with its distinctive emphasis on social and cultural spaces. The Great Hall was of notable significance to the city; there was a dearth of large performance venues in East Berlin, further exacerbated by the erection of the Berlin Wall. Block B at Funkhaus Berlin was a major infrastructural investment in music and drama during the 1950s but, unlike Sendesaal I at Haus des Rundfunks, its contribution to the GDR's cultural landscape never included public performances. There were few new venues of scale in East Berlin until the opening of the Great Hall and nothing to compare with the bold contribution made to cultural life in West Berlin by the Berlin Philharmonie in 1963. The Great Hall was not a direct response to the Berlin Philharmonie; East Berlin did not receive a dedicated symphony concert hall until 1984 with the renovation of the Konzerthaus Berlin. However, while the Great Hall was not conceived primarily as a concert hall, its broad cultural remit required that it could be used as such. That it could fulfil this role to any degree was only possible due to innovative technological interventions by the GDR's audio community, collectively developed under the title Delta Stereophony System. While the lifetime of the Great Hall itself was curtailed, the extended lifetime of this sound reinforcement system problematises residual suspicions of the GDR's inability to innovate in technological areas. The Great Hall's use as a concert hall also draws it into dialogue with design developments in post-war concert halls and venues and how similar organising design principles were enacted in very different ways. Furthermore, the Great Hall's dependence on sound technology for its acoustic design raises questions about the interaction between classical music performance and technology, sometimes elided in discussions of venues and concert acoustics. The manner in which the Great Hall performed the role of concert hall role also offers insights into how the GDR conceptualised a possible future for classical musical performance and classical music audiences.

4.1 Acoustic Design in Post-War Performance Venues

Until the twentieth century, the development of theatre and concert hall design was slow and fitful and an integrated appreciation for the role of the acoustic design, in particular, has been intermittent.[8] Occupying an uneasy space between science and art, methodical acoustic

[8] Victoria Newhouse, *Site and Sound : The Architecture and Acoustics of New Opera Houses and Concert Halls* (New York: Monacelli, 2012), 10.

research lagged behind other areas of physics until approached by Wallace Clement Sabine at the turn of the twentieth century. Sabine defined a single quantitative variable for acoustics: reverberation time (RT). This single variable was sufficient to assist him in designing the Boston Symphony Hall, widely assessed as one of the best concert halls in the world.[9] Although an emulation of historical shoebox-type concert halls and also drawing on contemporary general knowledge, Sabine's mathematical models incorporating RT were instrumental in allowing him to increase the scale of the hall without adversely impacting the acoustic result.[10] However, Sabine's acoustic legacy was mixed. Due in part to the success of the Boston Symphony Hall, acousticians took Sabine's single variable to be a determining factor in acoustic design and its significance was overemphasised for decades.[11] Acousticians eventually began to define further quantitative variables for assessing acoustics and these were increasingly applied in the decades after the Second World War. However, the unification of empirical method and a positive subjective result remained elusive and there were several high-profile failures of acoustic design, particularly of symphony concert halls, in the 1950s and 1960s. These failures can be attributed to continuing flaws in acoustic understanding but also tensions between contemporary acoustic design limitations and post-war cultural policy pressures to maximise access to concert halls. The infrequency of large concert hall commissions, the under-development of acoustic design and the heightened political stakes associated with high-culture infrastructure combine to create interesting points of comparison between cultural projects under different political systems during the post-war period. These comparisons can help determine how similar cultural priorities were embodied in different designs under different ideological regimes, as well as the extent to which technological approaches were allowed to offer new acoustic potentialities.

One of the important implications of Sabine's equation is the flexibility it allows – it doesn't prescribe a particular design in regards to layout, thus offering opportunity to detach from habitual designs of the past.[12] One of the most noteworthy acoustic designs of the twentieth century was also one of the most novel - the Berlin Philharmonie, designed by the architect Hans Scharoun and completed in 1963. The Berlin Philharmonie took a radical

[9] Leo L. Beranek, *Concert Halls and Opera Houses: Music, Acoustics, and Architecture*, Second edition.. (New York, N.Y.: Springer, 2004), 47.
[10] Vilhelm Lassen Jordan, *Acoustical Design of Concert Halls and Theatres: A Personal Account* (London: Applied Science Publishers, 1980), 34; Emily Ann Thompson, *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (Cambridge; London: MIT Press, 2002), 44.
[11] Jordan, *Acoustical Design of Concert Halls and Theatres*, 181.
[12] Thompson, *The Soundscape of Modernity*, 44.

approach by discarding many concert hall conventions by adopting a "vineyard" style that envelops the performance area with an audience seated on all sides.[13] Scharoun's vineyard design was influential on the design of concert halls around the world and in the GDR; the Kulturpalast Dresden (1969) and the Gewandhaus Leipzig (1981) both adopted similar features. Although the auditorium of the Berlin Philharmonie holds 2,218 seats, the design approach was successful in achieving a sense of intimacy unequalled by historical venues of similar capacity. The encirclement of the performance area with seating required the acoustic design to compensate for the absorptive effect of seated audience members. This was done by incorporating reflective surfaces into the design of the audience spaces. Reflective panels suspended above the orchestra help provide early reflections and the concert hall achieved its desired reverberation time of 1.9 seconds.[14] The acoustic could also be manipulated by altering the arrangement of physical components of the space, to subtly enhance its suitability for different types of classical performance. The architectural historian Victoria Newhouse writes that the Berlin Philharmonie "achieved an unprecedented feeling of egalitarianism and intimacy, with no listener more than one hundred feet from the stage".[15] This was not a passive intimacy, but an invitation to active participation that paralleled the role of citizens within a functioning democracy.[16] Scharoun's design was highly political and motivated by what Newhouse describes as a broad "democratising intention".[17] Scharoun's Berlin Philharmonie successfully united a politically-influenced design with effective acoustics, but his concert hall design was not the first to be influenced by democratising intentions prevalent after the Second World War.

The Royal Festival Hall in London is an early example. Designed within the context of the relatively progressive British post-war consensus, which sought to improve social provision as recompense for the British public's war-time contribution, the Royal Festival Hall was built in 1951 as part of the future-facing Festival of Britain. The Royal Festival Hall's involvement with this progressive democratising spirit was represented in part by its large seating capacity.

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[13] Beranek, *Concert Halls and Opera Houses*, 297.
[14] Beranek, 297.
[15] Newhouse, *Site and Sound*, 46.
[16] Hugh Campbell, '"The Bright Edifice of Community": Politics and Performance in Hans Scharoun's Berlin Philharmonie', *Arq : Architectural Research Quarterly; Cambridge* 11, no. 2 (June 2007): 160, http://dx.doi.org.ezproxy.is.ed.ac.uk/10.1017/S1359135507000632.
[17] Newhouse, *Site and Sound*, 46.

It opened with 2,901 seats but early plans indicate a planned capacity of 3,500.[18] The lower figure still exceeded the capacity of Sabine's Boston Symphony Hall, which was a direct influence. As a young man the Royal Festival Hall's lead acoustician, Hope Bagenal, had a formative written correspondence with Sabine.[19] Seeking to match or eclipse the achievement of Sabine's inclusive acoustic was a bold move for Bagenal but had the potential to introduce a new era of concert acoustics in Britain. Bagenal was emboldened by the apparent progress made in acoustic science since Sabine's time. The Royal Festival Hall was used to trial new acoustic design methodologies and was one of the earliest concert halls to incorporate predictive computer modelling in the formulation of its acoustic design.[20] However, the effectiveness of the computer modelling was negated because a key value used in the models - the sound absorption of a seated audience member - was inaccurate.[21] This resulted in the concert hall exhibiting a reverb time of 1.5 seconds at 500 Hz, instead of the planned 2.2 seconds.[22] Today, concert hall acoustics continue to elicit disparities between their subjective and objective assessments, but the degree to which the Royal Festival Hall diverged from its own models was drastic. A BBC Research Department report on the concert hall's acoustic from September 1951, suggested that the Royal Festival Hall acoustic design was caught between competing design trends towards "directed sound" and "diffuse sound".[23] The same report indicates that the designers were becoming aware of new qualitative acoustic concepts and analytical tools (e.g. "liveness", pulse technique) that would become standard over the coming decades, but these were still insufficiently developed to contribute at the design stage of the Royal Festival Hall.[24] Although the concert hall's truncated reverb time primarily impacted the Royal Festival Hall's acoustic effectiveness for large-scale romantic works, the design failure was a lingering embarrassment and coloured the venue's reputation from an early stage.[25] London already had a cautionary history of large capacity performance venues seeking to enhance public engagement with culture. The Royal Albert Hall was constructed with similar intentions to the Royal Festival Hall, but the scale of its ambitions were extremely destructive

[18] C.L.S. Gilford and T. Somerville, 'Acoustics of the Royal Festival Hall' (BBC Research Department, September 1951), 2, https://www.bbc.co.uk/rd/publications/rdreport_1951_15.
[19] Fiona Smyth, 'Hope Bagenal and Wallace Clement Sabine: A Legacy in Letters', *Acoustics Bulletin* 40, no. 2 (2015): 26–30.
[20] 'Acoustic Treatment of the Royal Festival Hall', *Proceedings of the Institution of Electronic and Radio Engineers* 2, no. 3 (May 1964): 64–65.
[21] Beranek, *Concert Halls and Opera Houses*, 245.
[22] Beranek, 245.
[23] Gilford and Somerville, 'Acoustics of the Royal Festival Hall', 7.
[24] Gilford and Somerville, 1.
[25] 'Acoustic Treatment of the Royal Festival Hall', 64.

to its acoustic efficacy. Designed to hold more than 5,000 people, numerous serious acoustic deficiencies were immediately apparent upon its inauguration and it took close to a hundred years of remedial action until they were conclusively resolved.[26] The Royal Festival Hall entered a similarly drawn-out process and several attempts at remedial action were made from an early stage. By 1962 the venue was judged to have reached the limit of what was possible through physical alteration but the acoustic was still critiqued as sub-optimal.[27] The next phase of alterations undertaken at the Royal Festival Hall during the early 1960s mark a pivotal moment in the merging of passive and active acoustics for classical performance venues and will be discussed later in this context. The Royal Festival Hall's original acoustic was a reminder that acoustic design remained capricious, but the concert hall's prominent shortcomings did not prevent further high-profile acoustic failures.

Similar problems to those experienced at the Royal Festival Hall, albeit with different causes, impacted the reputation of the New York Philharmonic Hall (known as Avery Fisher Hall 1973-2015, now known as David Geffen Hall), opened in 1962. The Philharmonic Hall was the first component of the landmark Lincoln Center for the Performing Arts. Conceived as a solution to the logistical and practical limitations of venerable venues such as the old Metropolitan Opera House and Carnegie Hall, the placement of several of New York's most prestigious performance groups in deliberate proximity with each other was a radical way of organising urban cultural bodies.[28] Collectively, the Lincoln Center represents probably the most prestigious example of post-war venue design in the US, but it has also been criticised for its destructive approach to urban renewal and its perceived isolation.[29] The designs of the individual venues themselves were less radical than their grouping. The Philharmonic Hall's auditorium was influenced by traditional shoe-box designs and the Boston Symphony Hall and Royal Festival Hall were both used as specific examples by the New York Philharmonic Society as to what the new auditorium should and should not be.[30] However, a flawed design process led to a deficient acoustic. The Philharmonic Hall's original design called for a capacity of 2,400 and the acoustician Leo Beranek conducted a comprehensive survey of venues across

[26] Beranek, *Concert Halls and Opera Houses*, 236.
[27] 'Acoustic Treatment of the Royal Festival Hall'.
[28] Edgar B. Young, *Lincoln Center, the Building of an Institution* (New York: New York University Press, 1980), 25.
[29] Newhouse, *Site and Sound*, 65.
[30] Thompson, *The Soundscape of Modernity*, 319.

the world to inform his design.[31] A combination of public and media pressure sought to increase the seating capacity to maintain the level of public access offered by Carnegie Hall.[32] The seating capacity was consequently increased to nearly 2,700 and this was a significant contributing factor to the problems with the final acoustic.[33] The perceived shortcomings of the Philharmonic Hall's became publicly apparent during the concert hall's opening gala and were the subject of scandal within the New York music community.[34] Like the Royal Festival Hall, the Philharmonic Hall underwent several attempts to positively improve its acoustic before undergoing a major renovation in 1976.[35] This renovation was successful at improving the acoustic and in maintaining the auditorium's large seating capacity at 2,742 seats.[36] The Philharmonic Hall was eventually able to confirm that large-capacity concert halls could be made to work acoustically, but also confirmed the continuing unpredictability of outcome regarding concert acoustics.

The Great Hall of Palast der Republik was built a decade after the Berlin Philharmonie, but democratic principles were similarly integral to its design, although these emerge in very different forms. The architect of the Great Hall, Manfred Prasser, believed it had practically no precedent: "hier wurde etwas völlig Neues gemacht" ("here something completely new was made").[37] Prasser was motivated in his design by a desire to create a communicative space that could host a large number of people, without the confrontational aspect of a traditional proscenium theatre.[38] Prasser's auditorium referenced Greek and Roman amphitheatres in its wide sweep although it also included a balcony level. The Great Hall had 5,000 seats over two levels: about 3,550 in the stalls and 1,450 in the balcony. Although situated within an unusual hexagonal groundplan, the seating layout of the Great Hall's larger configurations resembles the spatula-shaped "modern auditorium" template that Emily Thompson identifies as a response to electroacoustic sound reinforcement in the US from the 1920s onward.[39]

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[31] Michael Barron, *Auditorium Acoustics and Architectural Design*, Second edition. (London ; New York: Taylor & Francis, 2010), 91.
[32] Christopher Blair, 'Orchestral Acoustics 101: Avery Fisher Hall', Adaptistration, 5 August 2009, http://adaptistration.com/2009/08/05/orchestral-acoustics-101-avery-fisher-hall.
[33] Newhouse, *Site and Sound*, 90.
[34] Harold C. Schonberg, 'The Curse Of Fisher Hall's Acoustics', *The New York Times*, 13 October 1974, sec. Archives, https://www.nytimes.com/1974/10/13/archives/the-curse-of-fisher-halls-acoustics.html.
[35] Barron, *Auditorium Acoustics and Architectural Design*, 95.
[36] Beranek, *Concert Halls and Opera Houses*.
[37] Alfred Wagner, 'Gespräch mit Manfred Prasser, Architekt im Bau- und Montagekombinat Ingenieurhochbau Berlin', *Berliner Zeitung*, 7 October 1975, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19751007-0-9-148-0, ZEFYS.
[38] Wagner.
[39] Thompson, *The Soundscape of Modernity*, 248.

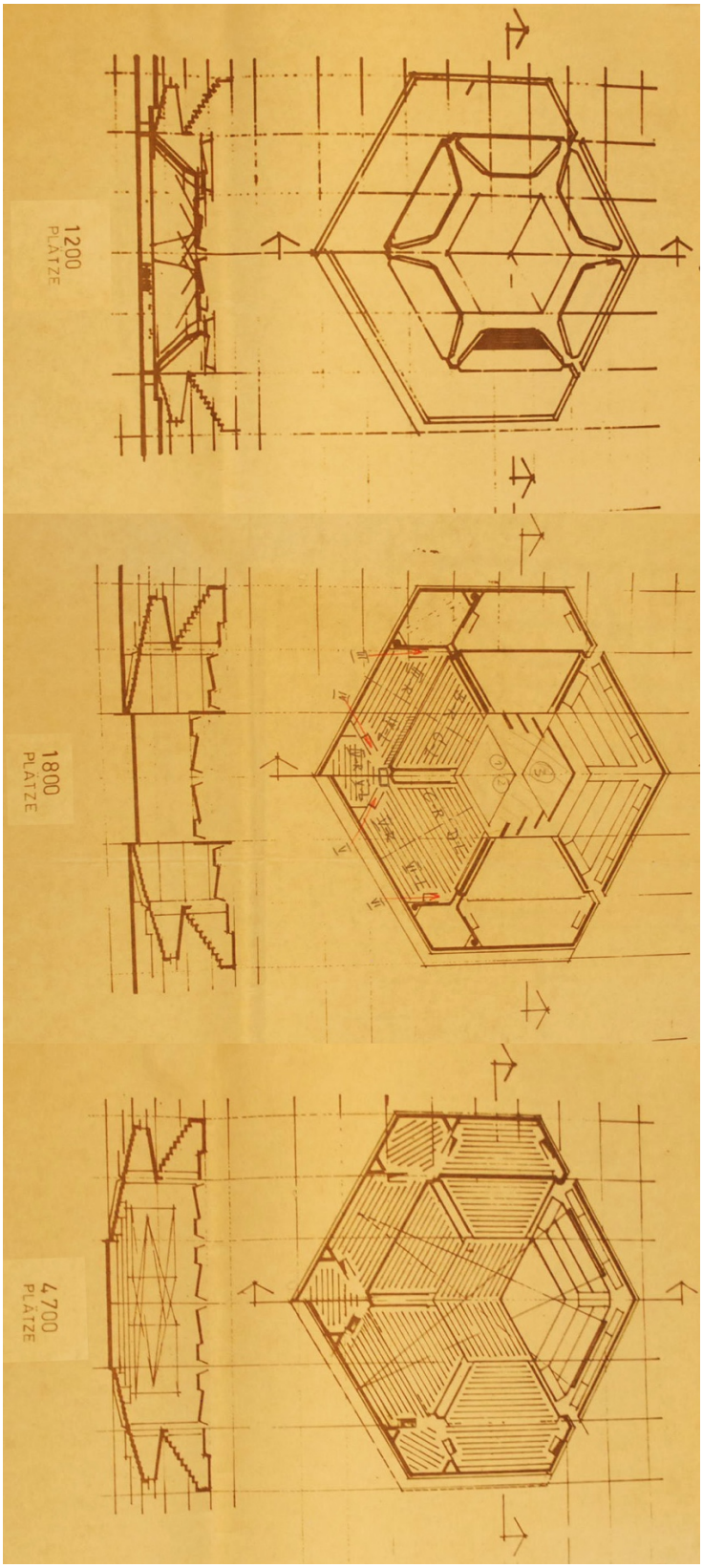

Figure 4.1: Provisional floor plans, cross sections and estimated capacities for three of the Great Hall's seating configurations. The plans give a sense of the Great Hall's non-traditional layout and the scale of its flexibility.[40]

[40] 'Kurze Zusamenfassung des Beschallungsplans der Palast der Republik' (Rundfunk und Fernsehtechnisches Zentralamt, 1974), 31/26/2/5, Deutches Rundfunk Archiv.

Electroacoustics were integral to the design and the Great Hall notably adopted a highly technological approach to enable its accommodation of a programme remit that covered almost every configuration of live and recorded performance. This approach deconstructed traditional divisions between different forms of performance by making similar levels of technical provision for acoustic and electrically amplified performances and the auditorium could also be configured in scale to reflect the needs of productions. This aspect of the Great Hall was influenced by another design trend in post-war performance venues; the inclusion of features to enhance their suitability for several types of cultural production. Multi-purposes venues became common in the US as venues were constructed in greater numbers outside of the main urban centres that could sustain single-purpose venues.[41] Multi-purpose venues were also constructed in Europe. In 1952 the Aalborghallen in Denmark included several technical features that allowed it to have several flexible configurations for theatre, concert performance and assembly with a capacity ranging from 1,400 to 3,200.[42]

The efficacy of multi-purpose designs could vary but they were influential on theatre construction in the latter-twentieth century. Several multi-purposes venues with capacities ranging between 1,000 and 3,000 were built in West Germany between 1963 and 1970.[43] The Great Hall was a conspicuous enlargement of the multi-purpose concept and the degree to which it could be transformed was extreme, as suggested by sample layout configurations shown in Figure 4.1. The Great Hall could be reduced to just 10% of its maximum seated capacity for small-scale theatrical performances.[44] Nearly every part of the auditorium had elements that could be reconfigured. Similar to other multi-purpose venues, the front seating rows could be wheeled away in large sections and stored in the sub-stage. The rear seating rows folded into the walls, so the entire floor space could be cleared for banqueting or dance events. Other features were less typical. While the seats in the balcony were fixed, the ceiling itself could be lowered by up to five metres to effectively separate the balcony from the space entirely. The ceiling lowered in sections to facilitate lighting and sound installations and the triangular plafonds of the ceiling could be angled to facilitate acoustic adjustments. In addition, the Great Hall had temporary dividing walls that could reduce the width of the auditorium. The

[41] Robin Mackenzie, *Auditorium Acoustics* (London: Applied Science Publishers, 1975), 43, 131–34.
[42] Jordan, *Acoustical Design of Concert Halls and Theatres*, 35.
[43] Mackenzie, *Auditorium Acoustics*, 131–34.
[44] Wagner, 'Gespräch mit Manfred Prasser, Architekt im Bau- und Montagekombinat Ingenieurhochbau Berlin'.

design aim was for each configuration to be fully integrated in terms of lighting, sound and other facilities, with each distinct configuration intended to feel complete and autonomous.

The flexibility of the Great Hall was not just to accommodate cultural functions. In a design consideration emblematic of a broader conflation of culture and politics that was characteristic of both the GDR and the Palast der Republik itself, the Great Hall could also serve as a congress hall for the GDR's ruling party, the SED. There were several features specifically geared towards this. These included folding writing tables integrated into the seating, as well as live television projection and translation facilities. Each chair also incorporated a small loudspeaker for speech transmission during conferences or speech-focussed uses. This was among the simplest elements of the Great Hall's acoustic design. The Hall was designed to accommodate all aspects of performance culture, high and low, small and large scale. While the consequent complexity of the Great Hall due to this extreme remit was significant, it aligned well with the GDR's capacity to produce results for high-profile projects. The GDR had a well-established and robust audio-engineering community that had been instrumental in introducing several technological advances during the previous two decades and which approached the Palast der Republik project with noticeable energy. The acousticians and architects of the Royal Festival Hall and the New York Philharmonic Hall utilised the best available technology and acoustic practice to create relatively conservative concert halls, yet in both cases were thwarted in fully executing their design intentions. The Great Hall had far fewer precedents to follow for its combination of scale, configurability and broad cultural programme. Nonetheless, the multiple uses of the Great Hall and, by extension, the multiple acoustics it required, were regarded as problems that could be overcome through technological means.

4.2 Active Acoustics

Every feature of the Great Hall had direct implications for its acoustic design. Its large size meant it would be heavily dependent on the integration of a sound reinforcement system. However, specific features of the Great Hall complicated conventional sound reinforcement solutions. The height of the ceiling and absence of a proscenium made the placement of loudspeakers to create a coherent sound field from the stage difficult using standard

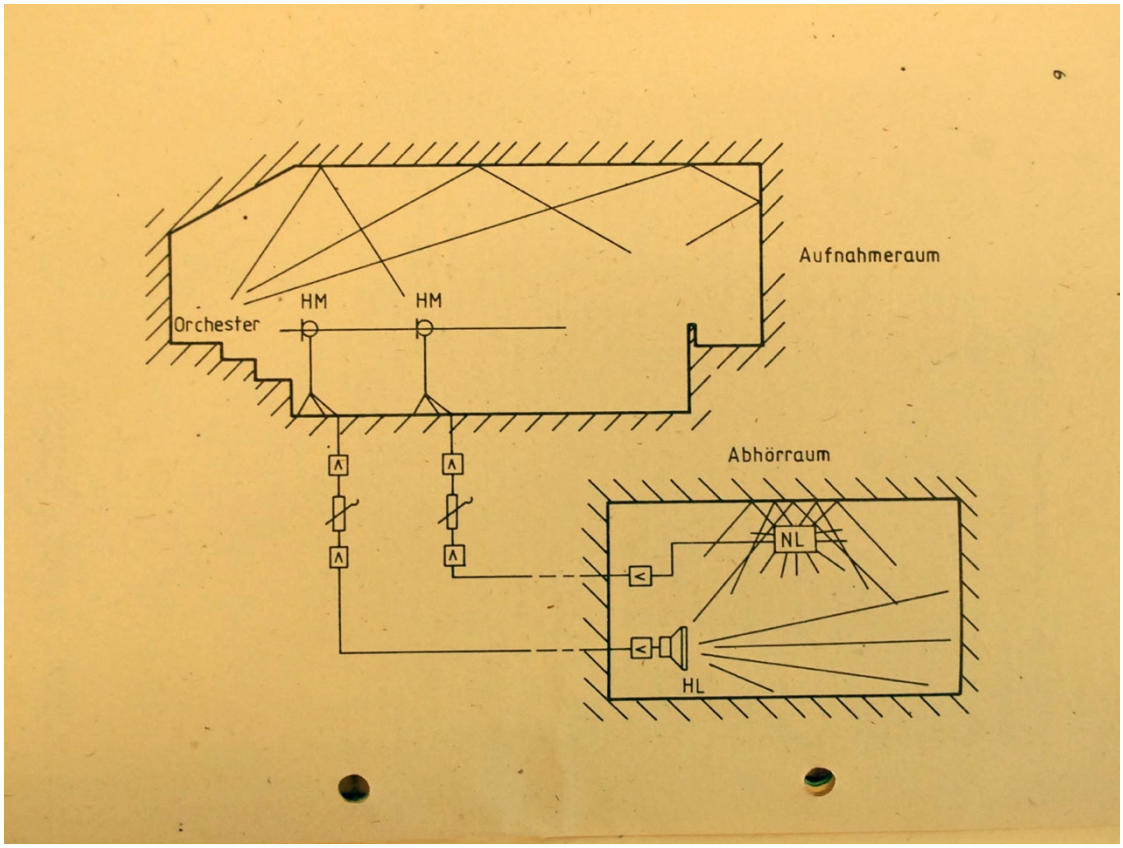

Figure 4.2: A diagram of Herbert Buttenberg's original 1950s conception of delta stereo. Originally conceived as a variant form of stereophonic recording and playback, Buttenberg's idea was upscaled in the 1970s to serve as the conceptual basis for a large-scale distributed sound reinforcement system.[45]

contemporary techniques. Interrelated to the question of sound reinforcement was the Great Hall's acoustic design, heavily constrained by the venue's multi-purpose intentions. The Great Hall's remit included symphony concert performances. An acoustic tailored for symphony orchestra typically requires a reverberation time of close to two seconds in the mid-range frequencies, but an acoustic of this type is problematic for most other musical or speech-dependent uses. Although multi-purpose venues had experimented with mechanical means for creating adjustable passive acoustics, the scale and degree of flexibility required by the Great Hall led the RFZ's workgroup to determine that an active acoustic system would be a better solution.[46] In principle, an active acoustic uses a variety of sound reinforcement and audio equipment to augment the passive, physical acoustic of a venue. An active acoustic system offered the potential to create an electronically malleable acoustic that could be altered to match

[45] 'Informationen der Studiotechnik Rundfunk' (Studiotechnik Rundfunk, January 1989), 6, 363/33/4/2/5, Deutches Rundfunk Archiv.
[46] Heinz Graffunder, 'Protokoll der Beratung mit dem Expertengremium "Akustik" am 11. 11. 1973 in der Aufbauleitung Sondervorhaben Berlin zum Objekt Palast der Republik' (Generalprojektant Palast der Republik, 10 November 1974), Deutches Rundfunk Archiv.

the various uses of the Great Hall. The decision to take this approach required the innovative application of acoustic theory integrated with an array of sound reinforcement and audio distribution techniques, culminating in the Delta Stereophony System (DSS).

The RFZ had a tradition of embracing new concepts and was happy to engage with the esoteric. During the introduction of stereo it pursued several pseudo-stereophonic methods to allow it to enhance heritage recordings, with some success.[47] During the 1970s, it was an enthusiastic adopter of Kopfkunst recording methods ("head art" – usually referred to as binaural recording outside of Germany) – a stereo technique that offers an enhanced sense of localisation when listened to on headphones – while the format enjoyed a brief period of popularity within some audio engineering circles.[48] This willingness to experiment with formats at the edges of convention also features in the provenance of DSS. The genesis of the format was research undertaken by the engineer Herbert Buttenberg at Haus des Rundfunks in the early 1950s.[49] Influential within the East German audio community, Buttenberg was intrigued by the potential of stereophonic recording and devised an alternative approach to stereo playback. Standard two-channel stereophony uses volume differences between the two channels to impart directional information, most effectively in the horizontal plane. More interested in imparting an impression of the room rather than a directional sense of left and right, Buttenberg experimented with separating the two channels into the transmission of a direct signal and a spatial signal. Buttenberg's original concept is illustrated in Figure 4.2. Calling this delta stereo, the idea was patented but found little application until the RFZ was searching for a methodology with which to approach the problematic acoustic of the Great Hall. Buttenberg's work offered a conceptual framework that originated within the GDR's own audio development history. However, Buttenberg's delta stereo was intended for recording and playback, not for live sound. It required substantial elaboration to become a holistic sound system suitable for application to the Great Hall. Its creation relied on the expertise of the GDR's audio community and audio equipment manufacturers, but it was also heavily reliant on acoustic research developments and new audio technologies from abroad.

[47] Klaus Wagner, 'Bericht der Arbeitsgemeinschaft "Pseudostereofone Bearbeitungsverfahren"' (Rundfunk und Fernsehtechnisches Zentralamt, 1967), 31/26/2/4, Deutches Rundfunk Archiv.
[48] Gerhard Steinke, 'Möglichkeiten und Grenzen der kopfbezogenen Stereofonie - im Vergleich zur raumbezogenen Stereofonie', *RFZ Fachberichte*, January 1979, 17.
[49] 'Informationen der Studiotechnik Rundfunk', 5.

While the classical music record market was an important driver of technical improvements in the world of recording and high-fidelity reproduction, popular music was much more significant in driving the application of technology to live music performance. As guitar amplifiers became more powerful during the 1960s, successful bands, such as the Grateful Dead and Pink Floyd, gave pioneering sound engineers the opportunity to apply these technical developments into new sound reinforcement systems and audio handling techniques.[50] By the time the Palast der Republik was being conceptualised, sound reinforcement capabilities were much improved. However, sound reinforcement was rarely applied to conventional classical music performances, which continued to rely primarily on the passive acoustics of an established circuit of appropriate venues. As the power, transparency and distribution possibilities of sound reinforcement technology continued to improve, technology originally intended for direct sound reinforcement began to be applied to altering room acoustics in subtler ways. Entrenched subjective acoustic parameters for classical performance, an aversion towards technological interventions and the cultural stakes associated with established classical music venues were obstacles to experimentation in this area. Early experiments were also constrained by continued deficiencies in the understanding of acoustics and sound perception. During the 1950s and 1960s improving theoretical understanding and advancing technological capabilities contributed to several important practical advances for enhancing passive acoustics by electronic means.

Underpinning the technological development of active acoustics were the important contributions made during the late 1940s and early 1950s to the understanding of how humans perceive sound. The work of sensory perception researchers like Hans Wallach and Helmut Haas had important implications for many aspects of sound reinforcement.[51] Their work on psychoacoustics, allied with the technical development of audio delay, led to the development of distributed sound systems by taking advantage of particular characteristics of human hearing to bypass the technical and practical limitations of sound reinforcement technology and create coherent sound fields on a large scale. Distributed sound systems have application for sound reinforcement approaches to both classical and popular music performance, but they were foundational to the beginning of effective active acoustic systems. Several early active acoustic

[50] Robert Greenfield, 'The King of LSD', *Rolling Stone*, 12 July 2007.
[51] Hans Wallach, E. B. Newman, and M. R. Rosenzweig, 'A Precedence Effect in Sound Localization', *The Journal of the Acoustical Society of America* 21, no. 4 (1 July 1949): 468–468, https://doi.org/10.1121/1.1917119.

installations are discussed below. These examples demonstrate that there was not a linear progression in the development of active acoustics in advance of the iteration that was used as a component of DSS. Each example used different technical methods under different circumstances and the intentions behind these experiments also varied substantially. Some of these systems were dedicated to enhancing a venue's acoustic (sometimes referred to as ambiophony), whereas others were focussed on speech distribution. However, the principles driving these different applications are similar and what the experiments do all share is the systematic integration of an improved understanding of psychoacoustic effects.

There is some evidence to show that sound reinforcement systems were historically used as an ad-hoc tool for enhancing the ambience of performance spaces during recordings. In 1947, a stereo recording experiment at Haus des Rundfunks sent a live microphone feed to Sendesaal I's sound system in an effort to improve a dry-sounding string section.[52] In the mid-1950s the Philips Research Laboratory in the Netherlands made one of the first methodical attempts to augment a venue using active means. Research by the engineer Roelof Vermeulen led him to develop an approach for enhancing the acoustics of a performance space considered sub-optimal for orchestral performance. Vermeulen believed that lateral sound reflections in music venues were an important and under-valued factor for good acoustics.[53] He regarded reverberation as an "inevitable subsidiary effect" of an acoustic suited to music, but regarded the diffuseness of the sound in the space as more significant.[54] As part of his research he designed a distributed loudspeaker system that could create an artificial reverberation field derived from the original sound source by applying intensity variations and audio delay. Vermeulen called his approach "stereo reverberation" and demonstrated it at the Gravesano and Nordwestdeutscher Rundfunk sound engineering conferences in 1955.[55] The RFZ was aware of Vermeulen's work from his regular attendances at Gravesano and his published work.[56] Vermeulen's system was later installed in venues in the Netherlands including the Philips Theatre in Eindhoven. The system used a line microphone consisting of ten condenser microphones mounted above the orchestra on a floating boom a metre long. Each microphone

[52] W. Lippert, 'Stereophonische Zweikanalübertragung mit dem Magnetophon', *Funk und Ton*, no. 5 (1947): 244.
[53] R. Vermeulen, 'Stereo Reverberation', *IRE Transactions on Audio* AU-4, no. 4 (July 1956): 98–105, https://doi.org/10.1109/TAU.1956.1165636.
[54] Vermeulen, 99.
[55] Roelof Vermeulen, 'Stereophonie und Stereonachhall', *Gravesaner Blätter*, July 1955, 132–41.
[56] Lothar Keibs and Gerhard Steinke, 'Laborbericht 345/40 (Tagungsbericht): "5 Jahre Gravesano" durchgeführt vom Elektroakustischen Experimentalstudio Gravesano am 8./9.August 1959' (Betriebslaboratorium für Rundfunk und Fernsehen, 13 August 1959), 4, 31/26/2/4, Deutches Rundfunk Archiv.

picked up minute differentials of intensity and phase in comparison to its neighbours and this gave the system a fairly wide range of stereophonic information to feed into the stereo reverberation system. These distinct signals were delayed by different values and then fed to loudspeakers positioned throughout the auditorium to enhance the reverberation field within the venue.[57] The delayed signals were distributed to the speakers on a random basis to increase the degree of diffusion. Psychoacoustic principles guided Vermeulen's design. The system was calibrated so that no audience member would hear the sound system more than 50 milliseconds after the direct sound from the stage.[58] This ensured that audience members perceived the sound emanating from the system as a seamless extension of the original sound, rather than as a distinct echo and destroying the effect.

In 1959 the Radio Corporation of America (RCA) used methods similar to Vermeulen's towards a different purpose when they designed and built a 300-seat "acoustoelectronic" auditorium at their labs in New Jersey.[59] This auditorium had one of the earliest distributed sound system for sound reinforcement and came about as the RCA believed that new venues were not integrating sound systems into their acoustic designs. The primary design remit of this innovative system was to transmit the speech of a speaker on stage at an appropriate level to all seats without the use of a conventional personal microphone or sound operator.[60] The physical fabric of the entire space was tailored to facilitate the goals of the sound system. The walls and floors of the venue were heavily sound absorbent and the stage was also carpeted. These room features created an extremely short reverberation time of 0.6 seconds in the mid-range in an effort to improve the ratio between the direct and electrically-reproduced sound. The sound system comprised of six overhead microphones covering the stage and the signal from these was distributed to 20 loudspeakers arranged in five rows in the ceiling above the auditorium seating. The most innovative feature of the RCA auditorium was how it handled and distributed the audio signal to these loudspeakers. Audio delay was used to synchronise each row of speakers with the direct sound emitted from the stage. This alignment of direct sound with reinforced sound maintained the impression of a speaker on stage speaking naturally without amplification, but improved intelligibility throughout the auditorium and maintained an even volume to all rows. Locating the loudspeakers in the ceiling also

[57] Vermeulen, 'Stereo Reverberation', 99.
[58] Vermeulen, 103.
[59] Harry F. Olson, 'Acoustoelectronic Auditorium', *The Journal of the Acoustical Society of America* 31, no. 7 (1 July 1959): 872, https://doi.org/10.1121/1.1907811.
[60] Olson, 873.

contributed to the system's goals of being visually and acoustically imperceptible. Worth noting is that the RCA system focussed exclusively on preserving localisation across the depth of the auditorium and not its width.[61] The six overhead stage microphones combined to create a single monophonic signal and the system did make any differentiation to the signal based on the speaker's location on the stage. The RCA system showed audio delay and distributed loudspeakers could be used to reinforce a stage sound source, but did not address issues of localisation. This was not problematic for a sound system in a space for a few hundred people; the scale and aesthetic demands of the Great Hall made this a much more pertinent issue in its design.

The introduction of active acoustics to established venues was not smooth. Vermeulen reported a good reception to his experiments from audience and orchestra members and his system was offered commercially, although it met with limited success.[62] Installed at the Teatro alla Scala in Milan in 1955, it initially received a positive reception there from conductors including Herbert von Karajan.[63] Nevertheless, it was deactivated permanently within three years due to dissatisfaction with feedback and colouration issues.[64] Vermeulen subsequently advocated that the use of active acoustics should not be disclosed to audiences saying,

> under no circumstances must the public become aware of the use of loudspeakers, for their reputation has become so bad by misuse that the mere suggestion that they are present can spoil appreciation of the performance, even when they are not in use.[65]

Vermeulen's comment re-emphasises the uneasy relationship between classical music audiences and technology, but his system undoubtedly had limitations. This contentious aspect of Vermeulen's experience was very influential on how one of the most high-profile early applications of active acoustics was undertaken.

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[61] Olson, 878.
[62] Vermeulen, 'Stereo Reverberation', 103.
[63] Kees Tazelaar, 'Roelof Vermeulen at Philips : A Search for Space in Music', *Musicologica Brunensia* 52, no. 1 (23 August 2017): 25.
[64] Barry Blesser and Linda-ruth Salter, *Spaces Speak, Are You Listening?: Experiencing Aural Architecture* (Cambridge, Mass.: MIT Press, 2009), 201.
[65] M. A. Poletti, 'Active Acoustic Systems for the Control of Room Acoustics', *Building Acoustics* 18, no. 3–4 (1 December 2011): 248, https://doi.org/10.1260/1351-010X.18.3-4.237.

During the early 1960s, the Royal Festival Hall - still dealing with lingering criticisms over its failed acoustic and after exhausting traditional remedial options - returned to the vanguard of acoustic science in an attempt to re-shape its acoustic. The management of the Royal Festival Hall approached the installation with a strong degree of trepidation. This contributed to the length of time the project took as the installation was not allowed to interfere with the venue's program. A staggered development, installation and assessment process, undertaken in two main stages, was not fully completed until 1969.[66] Overseen by the Building Research Station -Bagenal's acoustic consultancy responsible for the Royal Festival Hall's original acoustic design - the system that was eventually installed took more inspiration from ancient Greek auditoria than the experiments of Vermeulen or the RCA.[67] Some ancient auditoria incorporated Helmholtz resonators; simple hollow vessels with narrow mouths that vibrate at specific frequencies. Most often used in contemporary acoustic designs as acoustic absorbers, the Building Research Station's "assisted resonance" system instead used the acoustic properties of the resonators to bolster the auditorium's resonance across a specific range of frequencies.[68] This was done by installing 172 resonators across the ceiling of the auditorium and augmenting each resonator with a dynamic microphone, a 12-inch loudspeaker and a 3 Watt amplifier. Each resonator activated in sympathy with the programme material at a specific frequency and the electronic elements amplified the enhanced resonance back into the auditorium. The large number of resonators was required as each one only enhanced a very narrow frequency range. The initial installation stage focussed on enhancing the auditorium's resonance between 70 – 340 Hz, as this was identified as the area where the auditorium was particularly deficient.[69]

After the system's initial trial had a cautiously positive response, the installation was expanded to cover the frequency range from 58 - 700 Hz.[70] Although the assisted resonance system was highly distributed, it was essentially modular; each resonator acted independently and there was no centralised control. The modular aspect of the system also meant that the system was highly integrated into the auditorium's passive acoustic and the location of the sound source or the listener were not critical factors to the effectiveness of the system.

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[66] P. H. Parkin and K. Morgan, '"Assisted Resonance" in The Royal Festival Hall, London: 1965–1969', *The Journal of the Acoustical Society of America* 48, no. 5A (1 November 1970): 1025–35, https://doi.org/10.1121/1.1912240.
[67] Parkin and Morgan.
[68] Barron, *Auditorium Acoustics and Architectural Design*, 209.
[69] Parkin and Morgan, '"Assisted Resonance" in The Royal Festival Hall, London', 1025.
[70] Parkin and Morgan, 1025.

Musicians and conductors associated with the Royal Festival Hall were largely kept in the dark about the project and audiences were not informed at all until after several concerts had been performed with the system in place.[71] The acousticians themselves were also very restricted in their opportunities to assess the system. In the run-up to its inauguration, they were permitted only one full rehearsal where they were able to make comparative judgements based on switching the system on and off.[72] The system was a success and it was used without incident for more than twenty years, until it became increasingly unreliable and prone to disruptive outbursts of noise during the 1990s. Although it was integral to the Royal Festival Hall's acoustic for many years, active acoustic enhancement was not a component of a major renovation in 2007. However, the prestige of the Royal Festival Hall and the relative success of the assisted resonance system meant it was influential on active acoustic designs, including later iterations of DSS.

4.3 Kulturpalast Dresden and the RFZ as Venue Consultants

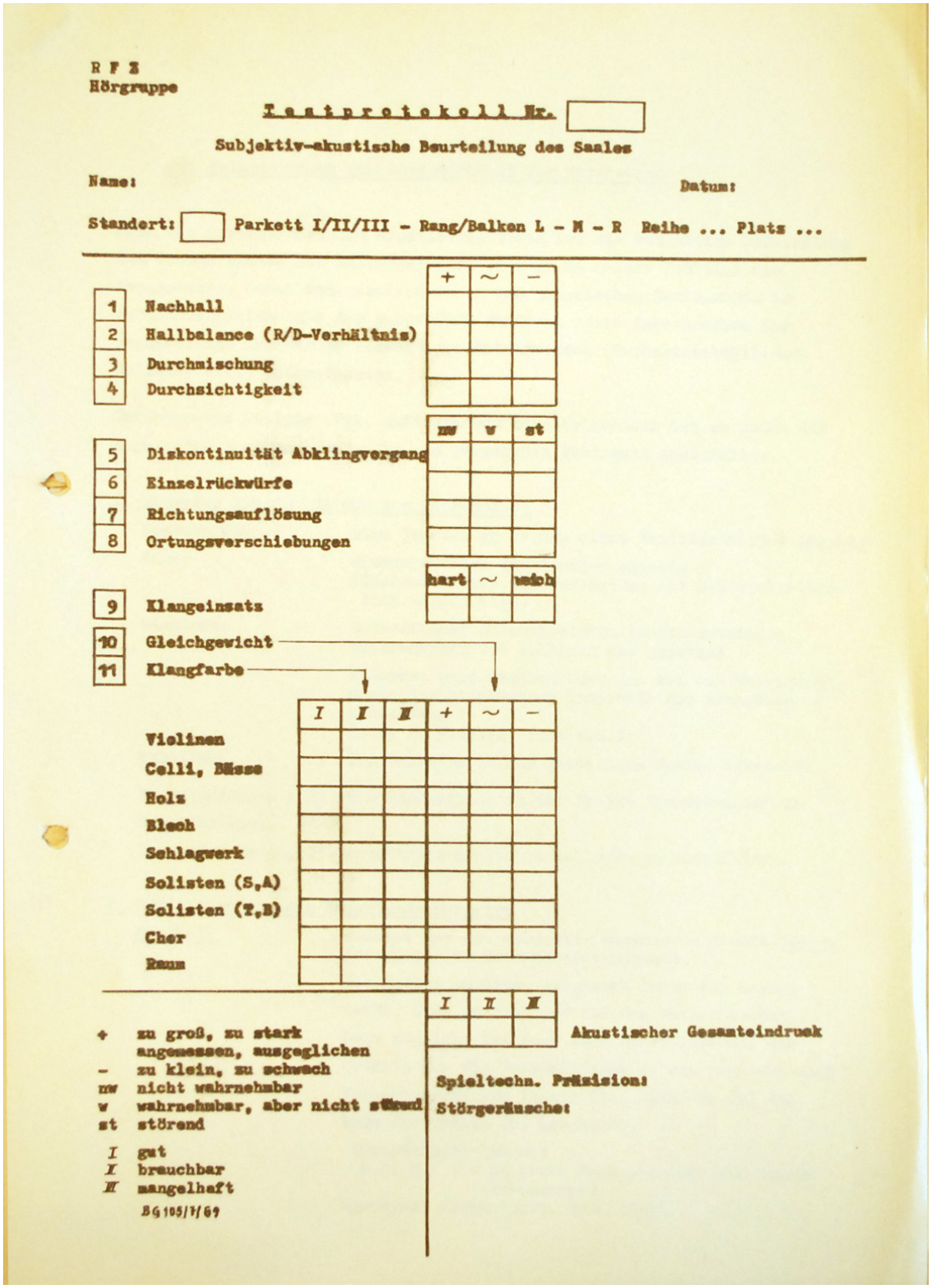
The RFZ had a broad technical expertise in audio applications but did not have a particular background in the application of technical solutions to live performance. Its involvement with the acoustic assessment of the Kulturpalast Dresden in 1969 was the beginning of a more direct involvement with GDR venue acoustics. The Kulturpalast's acoustic consultant was Walter Reichardt. Reichardt was director of the Technical Acoustics Institute in Dresden and he was well-renowned internationally for his involvement with efforts during the 1960s to improve the correlation between objective acoustic measurements and the subjective assessment of large halls.[73] An indicator of these efforts across acoustic communities was the proliferation of new qualitative and quantitative acoustic terms during this period, coined by acousticians like Reichardt, Lothar Cremer and Leo Beranek, among others. Beranek's role as the lead acoustician for the original New York Philharmonic Hall was damaging to his reputation, but he went on to publish influential work and pioneered subjective acoustic evaluation approaches.[74] Cremer made his name for his contribution to the Berliner Philharmonie's acoustic design and collaborated with Reichardt on standardisation work. Cremer credited him

[71] Parkin and Morgan, 1033.
[72] Parkin and Morgan, 1033.
[73] Jordan, *Acoustical Design of Concert Halls and Theatres*, 160.
[74] Barron, *Auditorium Acoustics and Architectural Design*, 3.

with helping to maintain a convergence between Eastern and Western measurement methods and acoustic quality evaluations.[75] Reichardt was particularly involved in quantifying the ratio of energy components contributing to "spatial sound" versus direct sound and how this ratio contributed to the subjective acoustic experience.[76] Reichardt invited the RFZ's Hörgruppe (Listening Group) to assist the Technische Universität Dresden (TU Dresden) with the final stages of the Kulturpalast's acoustic preparation.[77] The Hörgruppe was a specialised team of evaluative listeners initially founded during the early days of Funkhaus Berlin to help maintain standards and evaluate new methods. Gerhard Steinke and Walter Hoeg were among thirteen RFZ and TU Dresden engineers that worked on evaluating the venue's acoustic over several days in September and October 1969.[78]

The Kulturpalast tests used repertoire excerpts performed by the Dresdner Philharmonie and a children's choir to examine a number of different orchestral layouts and their influence on the acoustic in the auditorium and on stage. The RFZ and TU Dresden groups both made systematic but subjective assessments using eleven evaluative terms including reverb, balance, transparency and Klangfarbe (sound-colour), which were particular to the RFZ but representative of contemporary trends in acoustic evaluation.[79] A copy of one of test forms is reproduced in Figure 4.3 and the RFZ later shared its acoustic evaluation tables with other organisations.[80] The results of the Kulturpalast assessment were mostly positive. Although the musicians found the sound on stage to err on the side of dryness, they were also generally satisfied with the overall acoustic. This had been previously been a contentious area in the RFZ's experience when making early assessments of Saal 1 at Funkhaus Berlin.[81] Part of the formal assessment involved tabulating and comparing the evaluations by organisation, but no great variance between the RFZ and TU Dresden assessments was found.[82] Further tests in

[75] Lothar Cremer, 'Reichardt, Walter • 1903–1985', *The Journal of the Acoustical Society of America* 78, no. 5 (November 1985): 1915–1915, https://doi.org/10.1121/1.392739.
[76] Jordan, *Acoustical Design of Concert Halls and Theatres*, 160.
[77] Gerhard Steinke and Wolfgang Hoeg, 'Laborbericht Nr. 129/ER 5/69: Subjecktiv-akustische Beurteilung des Großen Saales im Kulturpalast Dresden' (Rundfunk und Fernsehtechnisches Zentralamt, 15 December 1969), 2, Deutches Rundfunk Archiv.
[78] Steinke and Hoeg, 10.
[79] Steinke and Hoeg, 14.
[80] Gerhard Steinke, 'Kurze Zusammenfassung der im Jahre 1969 erarbeiteten technisch-ästhetischen und musikalisch-akustischen Probleme' (Rundfunk und Fernsehtechnisches Zentralamt, 11 December 1969), Deutches Rundfunk Archiv.
[81] Steinke and Hoeg, 'Subjecktiv-akustische Beurteilung des Großen Saales im Kulturpalast Dresden', 20.
[82] Steinke and Hoeg, 14.



RFZ
Hörgruppe

Testprotokoll Nr. [ ]

Subjektiv-akustische Beurteilung des Saales

Name: Datum:

Standort: [ ] Parkett I/II/III - Rang/Balkon L - M - R Reihe ... Platz ...

		+	~	−
1	Nachhall			
2	Hallbalance (R/D-Verhältnis)			
3	Durchmischung			
4	Durchsichtigkeit			

		nw	w	st
5	Diskontinuität Abklingvorgang			
6	Einzelrückwürfe			
7	Richtungsauflösung			
8	Ortungsverschiebungen			

		hart	~	weich
9	Klangeinsatz			

10 Gleichgewicht
11 Klangfarbe

	I	II	III	+	~	−
Violinen						
Celli, Bässe						
Holz						
Blech						
Schlagwerk						
Solisten (S,A)						
Solisten (T,B)						
Chor						
Raum						

\+ zu groß, zu stark
angemessen, ausgeglichen
− zu klein, zu schwach
nw nicht wahrnehmbar
w wahrnehmbar, aber nicht störend
st störend

I gut
II brauchbar
III mangelhaft

BG 105/7/69

I	II	III

Akustischer Gesamteindruck

Spieltechn. Präzision:

Störgeräusche:

Figure 4.3: A rubric with eleven categories used to assess the acoustic of the Kulturpalast Dresden in 1969. The RFZ's Hörgruppe had long been developing practical methods and terms for assessing recordings and acoustics, alongside wider developments in the understanding of psycho-acoustics.[83]

[83] Steinke and Hoeg, 'Subjecktiv-akustische Beurteilung des Großen Saales im Kulturpalast Dresden'.

December 1969 with the Staatskappelle Dresden led to the determination that the "best" seat in the house was seat 23 in row 17.[84]

The RFZ also contributed to other areas of the Kulturpalast's finalisation. Although the Kulturpalast was optimised for use as a concert hall, there were some design concessions for multi-purpose use. Jazz was envisaged as part of the performance program and the venue also had an orchestra pit to allow for operatic and ballet productions. The RFZ's involvement with the calibration of the venue's sound reinforcement system prefigure its work on DSS and the Great Hall and it was a more marked departure from its typical work than its contribution to assessing the venue's passive acoustic. During a series of tests conducted before the orchestral layout assessment, Steinke and Klaus Wagner (an RFZ Tonmeister who also contributed to the auditorium tests) made several small but constructive alterations to the installed sound system. This included re-angling the speakers to improve coverage and inserting an equaliser into the signal chain.[85] The equaliser was an RFZ-designed W 732 and Steinke and Wagner reported that it made a significant improvement to the delivery of speech in the middle axis of the auditorium, critical to the auditorium's supplementary roles.[86] Although the Kulturpalast's monophonic sound system bore little comparison to the complexity of the DSS sound reinforcement system developed a few years later, it nonetheless marked a pivoting of the RFZ's remit towards large live sound systems. Steinke and Wagner were also part of an advocative process that saw the Kulturpalast adopt several sound reinforcement practices that were increasingly becoming standard internationally. The Kulturpalast sound system initially made no provision for stage monitors, but tests indicated these would be essential for jazz musicians and they were subsequently included in the venue specification.[87] Additionally, sound mixing was initially conducted from an enclosed control room. This restricted the sound engineer's ability to make an accurate assessment of conditions in the auditorium, but the importance of this role was quickly realised and the sound desk was brought into the auditorium and allocated space beneath the balcony.[88] At the time of the Kulturpalast's completion Steinke

[84] Steinke, 'Kurze Zusammenfassung der im Jahre 1969 erarbeiteten technisch-ästhetischen und musikalisch-akustischen Probleme'.
[85] Gerhard Steinke and Klaus Wagner, 'Laborbericht Nr. 125/ER 5/1969: Abgleich der Beschallungsanlage des Großen Saales im Haus der sozialistischen Kultur in Dresden' (Rundfunk und Fernsehtechnisches Zentralamt, 17 September 1969), Deutches Rundfunk Archiv.
[86] Steinke and Wagner, 2.
[87] Steinke, 'Kurze Zusammenfassung der im Jahre 1969 erarbeiteten technisch-ästhetischen und musikalisch-akustischen Probleme', 21.
[88] Wolfgang Ahnert and Frank Steffen, *Sound Reinforcement Engineering : Fundamentals and Practice* (London: Spon, 1999), 359.

and Hoeg were positive in their assessment of the new venue's primary attributes as a concert hall while reserving their optimism towards its multi-purpose aspects:

> In diesen Zusammenhang kann erstmalig für einen Kulturbau in der DDR die Bezeichnung "Konzertsaal" mit gutem Recht angewendet werden, auch wenn man noch nicht von einem optimalen Konzertsaal sprechen kann, was bei einem Mehrzweckbau nie möglich sein wird.[89]
>
> In this case, the term "concert hall" can justifiably be used for the first time to describe a cultural building in the GDR, even if we cannot yet speak of an excellent concert hall, which would never be possible with a multipurpose building.

Steinke, Hoeg and the RFZ were soon much more directly involved with a venue design-project with far more ambitious goals for multipurpose use. The RFZ's involvement with the Kulturpalast prompted it to engage further with sound reinforcement questions and it began to articulate its own aesthetic priorities in this area. Broadly, it saw the shared technical and aesthetic goal of sound reinforcement as being an integrated component of performance of which a typical audience member should be unaware.[90] Preceding their involvement with the Palast der Republik, Walter Hoeg and Klaus Wagner had already observed that sound reinforcement was occupying a growing role in the control of venue acoustics and they believed that the RFZ should engage with this. Their requests for the founding of a centralised GDR research centre in this area were not met and the cooperation between the RFZ and TU Dresden on the Kulturpalast provided the template for the DSS development process.[91]

4.4 Preparing DSS

The RFZ's involvement with sound reinforcement escalated in 1973 when they were asked to contribute to the electro-acoustic design of the Palast der Republik by Wolfgang Fasold, the lead acoustician of the project for the Bauakademie der DDR (GDR Academy of

[89] Steinke and Hoeg, 'Subjecktiv-akustische Beurteilung des Großen Saales im Kulturpalast Dresden', 22.
[90] Walter Hoeg and Klaus Wagner, 'Laborbericht Nr. 131 / ER 5/1969: Einige technische und ästhetische Probleme der Beschallungstechnik' (Rundfunk und Fernsehtechnisches Zentralamt, 25 November 1969), 3, Deutches Rundfunk Archiv.
[91] Hoeg and Wagner, 3.

Architecture).[92] Steinke responded proactively by setting up a special RFZ workgroup under his leadership - the Arbeitsgruppe Beschallungstechnik (Sound Reinforcement Workgroup) - as a sub-section of the Abteilung Tonstudiotechnologie (Department of Recording Studio Technology).[93] This RFZ workgroup project-managed a diverse team of engineers and acousticians from a range of GDR institutions; including Reichardt and some prominent contributors seconded from several departments of TU Dresden. The RFZ-led workgroup designed and oversaw the installation of a sophisticated conferencing and public address system in the Volkskammer plenary hall using predominantly GDR-manufactured technical equipment and it also designed bespoke solutions for the numerous ancillary public facilities of the Palast der Republik, including a bowling alley, casino, and nightclub.[94] However, the most innovative aspect of the project by a considerable degree was the multi-tiered electro-acoustic DSS-design devised for the Great Hall. The initial production remit that the RFZ workgroup was given to inform their design estimated that the Great Hall would hold 118 events a year.[95] The most challenging aspect of this was that the acoustic needed to work for at least fifteen diverse forms of production. Based on these requirements, the RFZ workgroup submitted its first general design in August 1973 and an initial sound reinforcement scheme followed a month later.[96] The first scale model of the auditorium was made in November of that year.[97] Steinke was enthused by the prospect and invited Fasold to contribute members of his architectural acoustics team to the RFZ's Hörgruppe so that there would be a balance of expertise across both passive and active acoustics.[98] Although Steinke admitted to Reichardt in a 1975 letter that the RFZ was venturing outside its traditional expertise by directing the design of the Great Hall's sound reinforcement system, he also stated that he saw it as a complementary field to his own studio- and broadcast-focussed work.[99]

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[92] Gerhard Steinke, 'Gerhard Steinke to Wolfgang Fasold', 30 August 1973, Deutches Rundfunk Archiv.
[93] Gerhard Steinke, 'Protokoll der Bestätigungsberatung für die Konzeption der Beschallungstechnik des "Palastes der Republik" am 29.10.1974 beim GAN' (Rundfunk und Fernsehtechnisches Zentralamt, 18 November 1974), Deutches Rundfunk Archiv.
[94] Gerhard Steinke and Frank Steffen, 'Entwurf: Konzeption für elektroakustische Schallverstärkungsanlagen (Beschallungsanlagen) im "Palast der Republik", Berlin' (Rundfunk und Fernsehtechnisches Zentralamt, 29 August 1973), 12, Deutches Rundfunk Archiv.
[95] Walter Hoeg, 'Großer Kongreßsaal' (Rundfunk und Fernsehtechnisches Zentralamt, 1974), Deutches Rundfunk Archiv.
[96] Graffunder, 'Protokoll der Beratung mit dem Expertengremium "Akustik" am 11. 11. 1973 in der Aufbauleitung Sondervorhaben Berlin zum Objekt Palast der Republik'.
[97] Graffunder.
[98] Steinke, 'Gerhard Steinke to Wolfgang Fasold', 30 August 1973.
[99] Gerhard Steinke, 'Gerhard Steinke to Walter Reichardt' (Rundfunk und Fernsehtechnisches Zentralamt, 11 April 1975), Deutches Rundfunk Archiv.

The DSS-design process incorporated extensive research of international active acoustics practices, but also a notable research trip. The Kremlin Palace of Congresses auditorium in Moscow was the most important source of practical experience with active acoustics available to the RFZ. Chiefly intended for large political meetings but also used for concerts, this large auditorium was already more than a decade old but had an electro-acoustic installation that was advanced for its time. Steinke and other members of the RFZ workgroup made a trip to see the 6,000 seat Soviet auditorium in November 1973.[100] First completed in 1961, the Kremlin Palace was large in volume (54,000 m3) and capacity but relatively traditional in its layout with a proscenium, stalls and balcony. The timing of the trip was fortuitous as the venue had undergone some technical upgrades to transistorised systems in the previous months and further technical upgrades were being planned for the following year.[101] The auditorium had a relatively short reverberation time for its size of 1.5 seconds between 125 Hz and 4 kHz, suitable for its primary usage for mass meetings and conventions.[102] Reliance on sound reinforcement for speech transmission was integrated into the acoustic design and accommodation for musical performance was made using ambience-enhancing loudspeakers installed along the ceiling and side and rear walls.[103] The Kremlin Palace's main sound reinforcement system consisted of five loudspeaker arrays installed above the stage proscenium, without any distributed elements. The stage was divided into five areas and the audio signal from these areas was distributed to the corresponding loudspeaker array. Based on the principle of intensity stereophony that allows volume differences between stereo loudspeakers to be interpreted as directional information, the system was designed to radiate a sound field that maintained coherence and accurate localisation of the speakers on stage as it propagated across the audience area.[104] The use of this approach as the organising principle of the Kremlin Palace sound system contrasts with the emphasis on audio delay to preserve coherence that characterised the development of experimental sound reinforcement systems in the West. While innovative in its scale and approach, the Kremlin Palace system's ability to maintain source localisation and even sound levels across the whole auditorium was not consistent.[105] Steinke found the visit to the Kremlin Palace helpful on several fronts, but its

[100] Gerhard Steinke, Wolfgang Hoeg, and Wolfgang Ahnert, 'Auslandsdienstreise Nr.: 163/73: Konsultation sowjetischer Experten zur Beschallungstechnologie für den "Palast der Republik"' (Rundfunk und Fernsehtechnisches Zentralamt, 27 November 1973), 31/26/2/5, Deutches Rundfunk Archiv.
[101] Steinke, Hoeg, and Ahnert, Anlage 1.
[102] Ahnert and Steffen, *Sound Reinforcement Engineering*, 365.
[103] Ahnert and Steffen, 366.
[104] Ahnert and Steffen, 276.
[105] Ahnert and Steffen, 276.

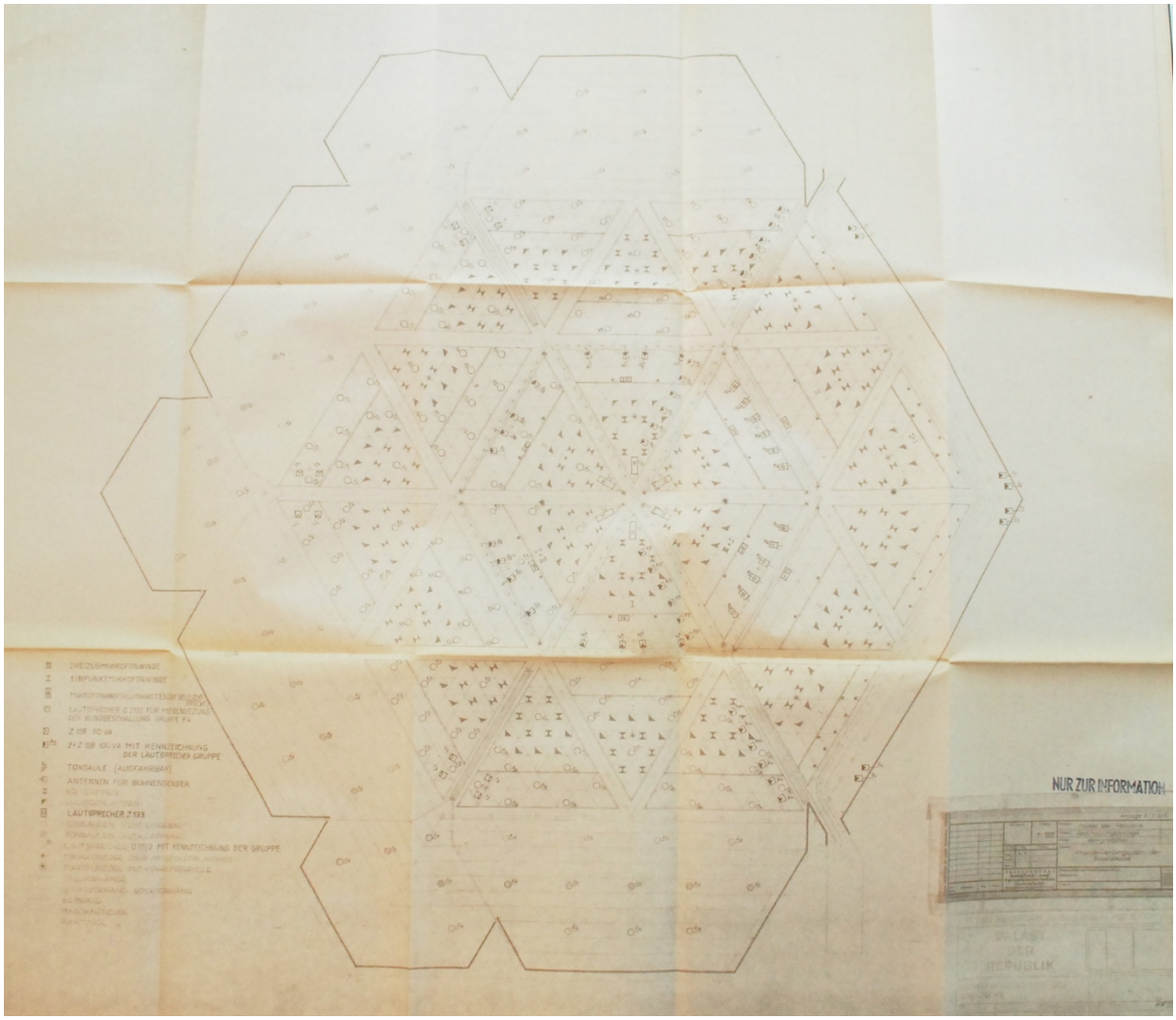

Figure 4.4: A loudspeaker distribution plan for the Great Hall. GDR theoretical and manufacturing expertise created a multi-tiered technical solution to address the scale and flexibility of the venue, but internationally sourced components were also key.[106]

relatively traditional layout in comparison to the Great Hall's unconventional plan and its far more limited range of uses meant that the RFZ still needed to implement a lot of its own solutions.[107] The principles underlying the Kremlin Palace sound system also had clear limitations and did not align with the methodologies driving the RFZ's DSS research or international sound reinforcement trends. The Soviets were accommodating in the analysis of their systems and were encouraging of the RFZ's efforts to surpass its limitations.[108] Reichardt

[106] 'Großes Saal Loudspeaker Plan' (Rundfunk und Fernsehtechnisches Zentralamt, 1974), 31/26/2/5, Deutches Rundfunk Archiv.
[107] Walter Reichardt, 'Ergänzende Bemerkungen zum Bericht "Technologische Grundsatzforderungen" der "Arbeitsgruppe Beschallungsanlagen" über die Projektierung der elektroakustischen Anlagen des Palastes der Republik in Berlin' (Rundfunk und Fernsehtechnisches Zentralamt, 22 May 1974), 3, Deutches Rundfunk Archiv.
[108] Gerhard Steinke, 'Vorschlag für Zuarbeit eines Schreibens an Minister Junker', 16 January 1974, Deutches Rundfunk Archiv.

in particular was bullish about the potential to surpass every aspect of the acoustic design of the Kremlin Palace.[109] Steinke was more reserved, particularly in regard to the limits of the Great Hall's multipurpose intentions. He was adamant that the Great Hall would only be capable of providing a good acoustic for the recording of symphony hall and not for concert performance.[110]

The DSS design coalesced steadily around principles that were different to those utilised by the Kremlin Palace and which are still commonly used by large distributed systems today. Instead of using intensity variations to transmit locational cues, DSS relied on audio delay to stagger the system's sound emissions to align with the original sound source on stage. This allowed the RFZ workgroup enough flexibility to distribute the system's loudspeakers quite widely within the Great Hall's auditorium. A sense of the scale of the DSS installation and its wide distribution through the auditorium is given by the loudspeaker distribution plan reproduced in Figure 4.4. The manipulation of a variety of psychoacoustic effects gave designers enough leeway to maintain an artificial alignment between the visual and audio image experienced by the audience.[111] As well as developing an overarching methodology based on consistent acoustic principles, the RFZ workgroup also had to develop a technological framework for DSS that could manifest their theoretical plans. TU Dresden took on major aspects of the technical research and sourcing of equipment associated with this.[112] GDR-manufactured audio equipment was emphasised in the original DSS design and the procurement of loudspeakers and amplifiers was relatively straight-forward due to a number of well-established GDR audio manufacturers. In June 1974 a provisional DSS layout for the Great Hall specified 278 individual loudspeakers to meet the projected requirements for coverage and sound level.[113] The eventual number of speakers that were eventually installed exceeded 400, excluding the small loudspeakers incorporated into the seating. The large number of loudspeakers required by Great Hall led the RFZ workgroup to take the decision of

[109] Reichardt, 'Ergänzende Bemerkungen zum Bericht "Technologische Grundsatzforderungen" der "Arbeitsgruppe Beschallungsanlagen" über die Projektierung der elektroakustischen Anlagen des Palastes der Republik in Berlin', 3.
[110] Steinke, 'Vorschlag für Zuarbeit eines Schreibens an Minister Junker', 16 January 1974, 2.
[111] Ahnert and Steffen, *Sound Reinforcement Engineering*, 278.
[112] W. Wöhle and Wolfgang Ahnert, 'Bericht Nr. PBA 17/73: Konzeption für eine elektroakustische Anlage zur Erhöhung der Räumlichkeit und Nachhallzeit in Großen Saal des Palast der Republik, Berlin' (Technische Universität Dresden, 27 February 1974), Deutches Rundfunk Archiv.
[113] W. Wöhle and Wolfgang Ahnert, 'Ergänzende Bermerkungen zu Technogische Grundsatzforderung für Ela-Anlagen im Palast der Republik Berlin sowie Stellungnahmen zu einigen Punkten der Bermerkungen von Prof. Reichardt' (Technische Universität Dresden, 5 June 1974), 2, Deutches Rundfunk Archiv.

proceeding with a high-impedance system design. In contemporary usage high-impedance systems are more often used for distributed paging systems, rather than high quality broad-band music systems, but this choice allowed all of the venues loudspeakers to be supplied by long cable runs from centrally located amplifiers.[114] The RFZ workgroup collaborated with VEB Musikelectronic Geithain on the development of the V 736 100 V amplifier for this purpose.[115] Musikelectronic Geithain is an audio company founded in the GDR in 1960 that developed increasingly high-end loudspeakers and audio equipment during the 1970s and 1980s and which later successfully navigated the commercially tumultuous reunification of East and West Germany.[116] The loudspeakers used in the Great Hall were of various types depending on their location and purpose, but they were all GDR-designed and manufactured. The primary loudspeakers used were Z 133s and Z 128s, variations of the Z 130 studio monitor developed by the RFZ.[117] Some of the smaller supplementary loudspeakers came from VEB Gerätebau Limbach, known for its Heliradio brand of radio sets.[118]

The ability to delay audio signals was just as critical to the technological framework of DSS as good quality loudspeakers, but it was considerably more difficult for the RFZ to procure. The technological development of methods for producing audio delay is important to understanding how distributed sound systems became possible, but also to how DSS ties into larger narratives of technological successes and failures in the GDR. During the 1950s and 1960s, as the utility of audio delay for sound reinforcement purposes was starting to be understood, generating delayed audio signals reliably was technically difficult and many different methods were trialled. The experimental active acoustic venues cited earlier are again instructive here. Vermeulen used bespoke audio delay equipment to create the artificial ambience he needed for his stereo reverberation system.[119] Vermeulen's signal delay was achieved with a solid metal "delay wheel"; the rim of the wheel acted as a magnetic recording surface similar in practice to a magnetic tape loop. A recording head and multiple playback heads around the circumference of the wheel were aligned to create several discrete delay times

[114] Ahnert and Steffen, *Sound Reinforcement Engineering*, 136.
[115] Schubert, 'Zuarbeit Konzeption Palast der Republik' (Rundfunk und Fernsehtechnisches Zentralamt, 3 April 1974), Deutches Rundfunk Archiv.
[116] 'Musikelectronic Geithain GmbH - Geschichte', accessed 16 July 2019, https://www.me-geithain.de/de/geschichte.html.
[117] Ahnert and Steffen, *Sound Reinforcement Engineering*, 353.
[118] Wöhle and Ahnert, 'Ergänzende Bermerkungen zu Technogische Grundsatzforderung für Ela-Anlagen im Palast der Republik Berlin sowie Stellungnahmen zu einigen Punkten der Bermerkungen von Prof. Reichardt', 4.
[119] Vermeulen, 'Stereo Reverberation', 99.

of the original signal. The delay wheel could generate between four and six separate lines of differentially delayed signals to produce the diffuse sound field within the auditorium. The RCA acoustoelectronic auditorium used two very different techniques - tape delay and acoustic delay - to offset the signals it distributed to the rows of loudspeakers it used.[120] Acoustic delay in this instance entailed a speaker coupled to a length of pipe with microphones set to pick up the delayed sound at positions calibrated to correspond to the amount of delay required. Although tape delay quickly became a superior and more commonplace method, in 1959 the RCA's acoustic delay method could achieve a better signal-to-noise ratio than its tape system.[121] By the time DSS was being developed in the mid-1970s, digital delay units were just beginning to become commercially available. However, audio peripherals and effects was an area where the GDR audio industry was relatively weak. In the late 1960s VEB Gerätebau Limbach was producing a spring reverb unit called the 0 750, but this was relatively unusual and the GDR was not producing any analogue or digital delay units during the mid-1970s.[122] This was not a problem that was particular to the GDR; the Kremlin Palace also relied on Western delay units.[123] The RFZ's short-term solution was to import the delay units it required and Danish Lyrec 7202s were initially considered.[124] These were eventually passed over and by the end of 1974 TU Dresden specified the West German-made EMT 440 instead, after also considering Austrian AKG units.[125] It was not a damning indictment of GDR industry that it could not produce a digital delay unit in 1974 – at that time digital delay was cutting-edge and its use was highly specialised. As the 1980s progressed and delay units used for subsequent DSS installations were consistently sourced from the West, this did become more indicative of terminal trends within the broader GDR electronics industry. Even then, as discussed below, the RFZ was agile enough to develop advantageous relationships with Western manufacturers that helped to considerably extend the reach of DSS.

4.5 Installation and Reception of DSS

[120] Olson, 'Acoustoelectronic Auditorium', 878.
[121] Olson, 878.
[122] Hoeg and Wagner, 'Laborbericht Nr. 131 / ER 5/1969: Einige technische und ästhetische Probleme der Beschallungstechnik', 15.
[123] Steinke, 'Vorschlag für Zuarbeit eines Schreibens an Minister Junker', 16 January 1974.
[124] Wöhle and Ahnert, 'Konzeption für eine elektroakustische Anlage zur Erhöhung der Räumlichkeit und Nachhallzeit in Großen Saal des Palast der Republik, Berlin', 3.
[125] W. Wöhle and Wolfgang Ahnert, 'Bericht Nr. PBA 24/74: Veränderte Konzeption der elektroakustischen Anlage zur Erhöhung der Raumlichkeit und Nachhallzeit im Kongreßsaal des Palast der Republik, Berlin' (Technische Universität Dresden, 14 October 1974), Deutches Rundfunk Archiv.

Steinke and Reichardt largely maintained their relative opinions of the capabilities of DSS in the run-up to its installation. Reichardt wrote:

> Sie ist neuartig. Auch deshalb kann ihre Bedeutung nicht aus ähnlich gelagerten Projeckten abgeleitet warden. Die Gefahr der Unterbewertung liegt selbst für einen Teil der Fachleute auf der Hand.[126]
>
> It is novel. That is why its significance cannot be inferred from similar completed projects. The risk of underestimation is clear even to some of the professionals.

Steinke remained more reserved and was particularly adamant that the Great Hall could not be considered to be the equivalent of a dedicated "Konzerthaus Berlin". Nonetheless he affirmed that DSS "den maximalen Kompromiß verwirklichen zu helfen" ("would help realise the best compromise").[127] Steinke communicated his wariness regarding the Great Hall's multi-purpose role to Reichardt directly, writing:

> Allerdings wird die konfiguration im Saal ohnehin zu manchem Kompromiß zwingen. Die Praxis wird zeigen, was mehr geschätzt wird.[128]
>
> In any case, the configuration of the hall will force many compromises. Practice will show what is more esteemed.

RFZ research was confidential by default, but the excitement surrounding the project and its innovative nature was enough to compel Steinke to issue a memo reminding staff of its sensitivity.[129] Staff were permitted to allude to DSS in general terms at conferences and subsequent to its installation, the RFZ began a sustained policy of promoting the system in academic circles.

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[126] Reichardt, 'Ergänzende Bemerkungen zum Bericht "Technologische Grundsatzforderungen" der "Arbeitsgruppe Beschallungsanlagen" über die Projektierung der elektroakustischen Anlagen des Palastes der Republik in Berlin', 2.
[127] Steinke, 'Vorschlag für Zuarbeit eines Schreibens an Minister Junker', 16 January 1974.
[128] Steinke, 'Gerhard Steinke to Walter Reichardt', 3.
[129] Gerhard Steinke, 'Geheimhaltung unserer Zuarbeiten für den "PdR"', 8 July 1974, Deutches Rundfunk Archiv.

The run up to the opening of the Palast der Republik received substantial coverage in the GDR media. From its initiation the project was emphasised as the "Palace of the People" and the valorisation of its construction teams was a big feature of media coverage during its construction with portraits of labourers displayed in the street during its construction.[130] During the construction period the builders and contractors were featured in newspaper articles that emphasised the speed and efficiency of the process and the dedication of the workers to the socialist values the Palast der Republik emblematised.[131] VEB Sächsischer Brücken- und Stahlhochbau Dresden (SBS) was the firm responsible for the installation of lifts and escalators and other general services, but it also handled the installation of the stage machinery and seating for the Great Hall itself.[132] SBS had previously made theatrical installations at the Maxim-Gorki Theatre in Moscow. SBS was able to claim that "die gesamte Technik für den Großen Saal liefern ausnahmslos Betriebe unserer Republik" ("all the equipment for the Great Hall was supplied without exception by companies of our republic").[133] The RFZ came close to being able to make a similar claim for DSS, with the EMT audio delay units being the most significant exception. Despite the major acoustic challenges posed by the Great Hall's substantial configurability and the GDR's general eagerness to fixate on technological solutions, DSS was not a feature of general coverage of the Palast der Republik. While good acoustics were often cited as an important goal in general terms, this was often in the same breath as comments about the building's advanced air-conditioning facilities.[134] The link made by the media between the Palast der Republik's cultural function and its construction teams remained prominent after its completion. The expansion of a pre-existing concert series for building labourers became a conspicuous part of the Great Hall's programme and was a useful way to demonstrate the ability of the new venue to serve multiple cultural constituencies. These concerts also expand the terms of evaluation for the suitability of the Great Hall as a venue for classical music performance.

DSS was installed in the Great Hall during the early months of 1976 and testing began in March. By 27 March the full system was used for a number of technical rehearsal shows,

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[130] Wagner, 'Am Berliner Marx-Engels-Platz entsteht ein Haus des Volkes - ein Palast für uns alle'.
[131] Jürgen Bielefeld, 'Decke aus Fertigteilen wurde großer Schlager', *Neues Deutschland*, 2 October 1975, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19751002-0-8-142-0, ZEFYS.
[132] Erhard Klotz, 'Montage der Schwenkparkette im Großen Saal bald beendet', *Neues Deutschland*, 2 April 1975, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19750402-0-8-152-0, ZEFYS.
[133] Klotz.
[134] Wagner, 'Am Berliner Marx-Engels-Platz entsteht ein Haus des Volkes - ein Palast für uns alle'.

Figure 4.5: View of the Great Hall in one of its larger configurations preparing for a musical performance during the early 1980s. The primary loudspeaker hangs are visible across the top of the picture, interspersed among the venue's adjustable triangular plafonds. The venue's mixing desk is also visible at bottom centre.[135]

the project's building and contracting staff in attendance by way of reward.[136] These preparatory shows were rehearsed in the venue from 21-25 March and included a children's choir, a Schlager band and a ballet performance with a pre-recorded musical backing.[137] These shows were presented in the 3,800 seater "panorama" seating configuration and helped inform final technical decisions, such as the installation of additional speakers along the front stage edge to reach some back-row seats considered to be in the shadow of the main loudspeaker groups.[138] TU Dresden also made impulse recordings to assess the final characteristics of the auditorium.[139] Assessments of the system continued in the run-up to the venue's official opening shows at the end of April.[140] The venue's official opening productions were of a larger scale to the March shows and were preceded by another period of intensive rehearsal and technical calibration. The opening gala program included several of Rundfunk DDR's string ensembles and its choir, along with several ballet companies, theatre groups and a Soviet blues

[135] Gerhard Steinke, 'Delta Stereophony - A Sound System with True Direction and Distance Perception for Large Multipurpose Halls', *Journal of the Audio Engineering Society* 31, no. 7 (1983): 505.
[136] Gerhard Steinke, 'Vor-Gutachten Nr. 1976/FST/5: Einschätzung von ersten Erprobungen der Beschallungsanlagen im "Palast der Republik", Berlin, vom 15.3.76 bis 1.5.76' (Rundfunk und Fernsehtechnisches Zentralamt, 5 May 1976), Deutches Rundfunk Archiv.
[137] Gerhard Steinke, 'Vorläufiger Arbeitsplan für Sonntag, 21. - 25. März 76' (Rundfunk und Fernsehtechnisches Zentralamt, March 1976), Deutches Rundfunk Archiv.
[138] Steinke, 'Vor-Gutachten Nr. 1976/FST/5: Einschätzung von ersten Erprobungen der Beschallungsanlagen im "Palast der Republik", Berlin, vom 15.3.76 bis 1.5.76', 7.
[139] Steinke, 7.
[140] Steinke, 10.

orchestra. The official opening production was held on 23 April and was also used as the first opportunity to trial the venue's facilities for radio and TV outside broadcasting.[141] Figure 4.5 gives a good sense of the venue in its heyday.

The first prestige classical music event at the Great Hall was the launching in May 1976 of a new concert series specific to the Palast der Republik, "Orchester der Welt". The large audience capacity of the Great Hall allowed this series to be framed as a new departure in audience outreach.[142] The series was opened by the Leipzig Gewandhaus Orchestra under Kurt Masur playing a programme of Strauss' *Don Juan,* Prokofiev's *Piano Concerto No. 3* and Beethoven's *Symphony No. 7*, with the overture from Wagner's *Die Meistersinger von Nürnberg* as an encore. The concert was also the first rigorous test of DSS's claims to acoustic flexibility. DSS was able to extend the reverberation time of the Great Hall to up to two seconds, in theory making it suitable for symphony orchestra performance.[143] Initial critical reactions to the Great Hall's concert acoustic made allowances for the unusual surroundings. The critic in the Neue Zeit, Eckart Schwinger, credited Masur for wrestling with the unfamiliar sound.[144] In the Berliner Zeitung, Hans-Peter Müller gave a balanced appraisal, praising the audibility and clarity of the venue, but lamenting how a sense of distance detracted from the experience of the performance:

> Die Akustik deckte den Orchesterklang nicht zu, vermittelte von ihm ein recht anschauliches Bild, nicht zuletzt in den Instrumentalsoli, wenn auch der Hörer bei solchen Entfernungen zu den Ausführenden sich nicht direkt einbezogen und angesprochen fühlt, mehr Betrachter als Beteiligter ist.[145]
>
> The acoustic did not obscure the orchestral sound, conveying a very vivid picture, not least for the instrumental solos, even if the listener is at such a distance from the

[141] Gerhard Steinke, 'Vorbereitung der Eröffnungsveranstaltung am 23. 4. 76.' (Rundfunk und Fernsehtechnisches Zentralamt, 13 April 1976), 6, Deutches Rundfunk Archiv.
[142] Hans-Peter Müller, 'NeueKonzertstätte für Berlin', *Berliner Zeitung*, 4 May 1976, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19760504-0-6-89-0, ZEFYS.
[143] Steinke and Steffen, 'Entwurf: Konzeption für elektroakustische Schallverstärkungsanlagen (Beschallungsanlagen) im "Palast der Republik", Berlin', 4.
[144] Eckart Schwinger, 'Orchester der Welt gastieren im Palast', *Neue Zeit*, 4 May 1976, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2612273X-19761109-0-4-52-0, ZEFYS.
[145] Müller, 'NeueKonzertstätte für Berlin'.

performers that they don't feel directly involved and addressed, and are more of a beholder than a participant.

The Orchester der Welt series was designed to bring major symphony orchestras to East Berlin. It continued in November 1976 with the visit of the Leningrad Philharmonic under Yevgeny Mravinski with a Shostakovich programme consisting of his fifth and sixth symphonies. Schwinger was admiring of Mravinski and the orchestra but began to share Müller's sense of alienation, while also directly identifying the Great Hall's technical acoustic system as problematic:

> Wenn einiges zu verhalten, klanglich zu kühl wirkte, man sich nicht immer unmittelbar hineingenommen fühlte in das musikalische Geschehen, ist das auf die Akustik, die noch nicht befriedigende Übertragungstechnik des Saales zurückzuführen.[146]
>
> If a lot were to improve, the sound was too cool, one did not always feel directly involved in the musical occurrences, due to the acoustic, the still not yet satisfactory transmission technology of the hall.

Müller and Schwinger continued to expand their critiques of the Great Hall's concert acoustic in 1977. At the Berlin Music-Biennale in 1977 with the Rundfunk Sinfonie Orchester Berlin, Müller reported:

> Man sah zwar mit dem Auge den intensiven Einsatz des Orchesters, hörte aber über Verstärkeranlage eine verschwommene und undifferenzierte Klangwiedergabe… Jedenfalls beeinträchtigten hallige Lautsprechereffekte sehr stark die klanggewaltige und abschließend dargebotene Prokofiew-Sinfonie.[147]

[146] Eckart Schwinger, 'Faszination eines Orchesters: Leningrader Philharmonie eröffnete Tage der UdSSR-Musikkultur', *Neue Zeit*, 9 November 1976, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2612273X-19761109-0-4-52-0, ZEFYS.
[147] Hans-Peter Müller, 'Bemerkenswerte neue Sinfonik Erst- und Uraufführungen zur Berliner Musik-Biennale 1977', *Berliner Zeitung*, 23 February 1977, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19770223-0-6-114-0, ZEFYS.

> One could indeed see with the eye the intensive commitment of the orchestra, but heard over the amplifier system a blurred and undifferentiated sound reproduction… In any case, echoing loudspeaker effects severely impacted the sonorous and concluding Prokofiev Symphony.

At a subsequent Biennale concert by the Rundfunk Sinfonie Orchester and Rundfunk Chor, Schwinger stepped-up his criticism of DSS:

> Daß dabei viel von der einkomponierten dynamischen Differenziertheit und Klangfarbenfeinheit verloren ging, ist auf die stark übersteuerte elektro-akustische Saalbeschallung zurückzuführen, bei der zum Beispiel die hohen Streicher wie elektrische Geigen klangen.[148]
>
> Here much of the intended dynamic differentiation and fineness of sound-colour was lost due to the strongly overdriven electro-acoustic sound system, in which, for example, the high strings sounded like electric violins.

Schwinger and Müller's direct references to the sound reinforcement system suggest that the degree to which DSS was contributing to the Great Hall's concert acoustic was increasing, perhaps to address the critiques of the concert acoustic as dry, but with a detrimental result. The progression in their critiques from a recognition of the auditorium's clarity, but with an associated sense of distance that was perhaps unavoidable given the venue's large scale, to a situation where DSS was negatively impinging on orchestral performances, allows a number of inferences. Steinke's views on the limitations on the system were confirmed, but the problematic experiences Schwinger and Müller described in 1977 are suggestive of operating problems as much as systematic ones. It was never likely that the Great Hall and DSS could together create a sense of inclusivity similar to that attained by a venue like the Berliner Philharmonie. The Berliner Philharmonie was exclusively directed towards that purpose and even features like its warm colour scheme have been identified as contributing factors – in tandem with its acoustic design and seating layout – in the creation of a powerfully positive

[148] Eckart Schwinger, 'Orpheus und Dichter von heutel: Notizen von der VI. Musik-Biennale', *Neue Zeit*, 24 February 1977, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2612273X-19770224-0-4-197-0, ZEFYS.

psycho-acoustic experience.[149] The Great Hall was created to generate a different sense of inclusivity through continually re-shaping itself to host diverse forms of performance and by accommodating as large an audience as possible. For classical music concert performances – the performance form that required the most drastic acoustic divergence from its default passive acoustic – it succeeded in creating a functional acoustic, with psycho-acoustic limitations similar to those experienced at some of the most prestigious new dedicated concert halls of the previous twenty-five years. The malleability of DSS, however, also allowed for misuse.

While East Berlin still required a Konzerthaus to serve the traditional requirements of its dedicated classical performance audience, the Great Hall found a role as a venue for staging classical performances for new audiences. The Great Hall began to be used to continue an outreach concert series that was begun in 1968 and which involved the Rundfunk Sinfonie Orchester Berlin and a number of East Berlin building collectives. The initiative involved pre-concert talks and performances at venues like the Kongresshalle am Alexanderplatz and the Volksbühne. [150] The programmes for these concerts initially prioritised repertoire with entertainment value but positive experiences encouraged the programming of more "serious" works. Reporting on the expansion of the series, the Neues Deutschland commented:

> "Vorsichtig" wurden die ersten Programme disponiert. Sogenannte unterhaltende Musik (die bekanntlich dennoch nützlich und anregend sein kann, wenn sie gut ist) stand am Beginn. Doch bald konnten die Berliner Sinfoniker ihr neues Publikum auch durchaus mitten in ihr eigentliches Arbeitsfeld führen.[151]
>
> The early scheduled programs were "cautious". So-called light music (which, as we know, can still be useful and stimulating, when it is good) was the starting point. But soon the Berliner Sinfoniker were able to lead their new audiences right into the middle of their actual field of work.

[149] Newhouse, *Site and Sound*, 126.
[150] 'Gegenwartsmusik im 19. BSO-Konzert für Berliner Bauarbeiter', *Neues Deutschland*, 17 June 1974, 165 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19740617-0-4-181-0, ZEFYS.
[151] Hansjürgen Schaefer, 'Berliner Bauarbeiter im Konzertabonnement', *Neues Deutschland*, 22 June 1976, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2532889X-19760622-0-4-48-0, ZEFYS.

From 1974 contemporary compositions were included in the programme and this was interpreted as a positive indicator of the degree to which the builders were engaging with the series. The transferring of the concert series to the Great Hall with its increased capacity was viewed as essential to the expansion of what was already a successful outreach initiative.[152] The Great Hall found other concert roles to which it was well suited. The GDR consistently sought to make a special claim on the music of Beethoven and characterised him as a proto-social realist.[153] Beethoven's Ninth became part of a developing tradition of New Year's Eve concerts at the Great Hall. The music director of the Rundfunk Sinfonie Orchester, Heinz Rögner, was taken with the Great Hall's ability to house this celebratory moment, saying:

> Der Große Saal des Palastes mit seiner riesigen Platzkapazität… bewährt sich gerade bei der Neunten glänzend.[154]
>
> The Great Hall of the Palace with its huge capacity… is proving to be brilliant for the Ninth.

The Great Hall's shortcomings for dedicated classical music performance remained a sore point, but they could occasionally be overcome. A Berliner Sinfonieorchester performance under Günther Herbig in 1978 prompted Müller to report:

> Nach diesem konzertanten Leckerbissen folgte eine orchestrale Spitzenleistung: Brahms 4. Sinfonie in einer spannungsvollen und konzentrierten Wiedergabe, einer klugen und künstlerisch inspirierten Interpretation, bei der man selbst die akustischen Tücken des Saales fast vergessen konnte, weil der zündende Funke aufs Publikum übersprang.[155]

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[152] Schaefer.
[153] Esteban Buch, *Beethoven's Ninth: A Political History* (Chicago ; London: University of Chicago Press, 2003), 222.
[154] 'Internationale Konzerterfolge: Interview mit Generalmusikdirektor Heinz Rogner', *Neue Zeit*, 11 August 1978, 188 edition, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP2612273X-19780811-0-4-52-0, ZEFYS.
[155] Hans-Peter Müller, 'Auftakt mit Janacek: Eröffnungskonzert im Palast der Republik', *Berliner Zeitung*, 2 October 1978, http://zefys.staatsbibliothek-berlin.de/ddr-presse/ergebnisanzeige/?purl=SNP26120215-19781002-0-6-106-0, ZEFYS.

> A top orchestral performance followed the concert appetisers: Brahms Symphony No. 4 in a suspenseful and concentrated performance, a clever and artistically inspired interpretation, in which even the acoustic pitfalls of the hall could almost be forgotten, because the spark ignited the audience.

There is some precedent for large novel auditorium forms with multi-use intentions requiring time to ascertain what they are and are not suited to – the Auditorium Theatre in Chicago and the Radio City Music Hall in New York both needed to reconfigure their usage to match their capabilities after problems with their original programmes long before the construction of the Great Hall.[156] The Palast der Republik and its facilities were important contributors to the cultural fabric of East Berlin, but whether the reception of the Great Hall's acoustic for classical music performance improved over the course of its usage requires further investigation.

4.6 DSS beyond the Palast der Republik

Despite the negative reception towards the Great Hall's capacities as a concert hall, the RFZ considered DSS to be a technological and procedural success and began to publicise DSS in academic acoustics and sound engineering publications. They presented two papers on DSS at an acoustic conference in Bucharest in 1976 and DSS presentations were a regular occurrence at AES conferences in the US during the 1980s. Distributed sound systems were becoming more common during this period, and the opening of the Internationales Congress Centrum (ICC) in West Berlin in 1979 invites a comparison between what were the two largest indoor venues in East and West Berlin. The ICC and the Palast der Republik each had multiple functions, but both had 5,000 seat venues as their centrepieces with auditoriums that relied on sophisticated sound reinforcement systems. However, the motivations behind the ICC's construction contrasted with those of the Palast der Republick; it was primarily a commercial exhibition and conference centre. The ICC auditorium's design was also distinct. Unlike the Great Hall, the ICC auditorium had a linear boundary between the stage and the audience with a defined proscenium.[157] The ICC auditorium was less pliable than the Great Hall in terms of seating and layout and its sound reinforcement system heavily prioritised conference and

[156] Thompson, *The Soundscape of Modernity*, 30.
[157] Ahnert and Steffen, *Sound Reinforcement Engineering*, 277.

discussion uses. One of the most distinctive elements of the sound system was a collection of spherical loudspeaker clusters suspended above the audience; a sophisticated switching system allowed the entire system to be time-aligned to a microphone positioned anywhere on the stage or in the audience.[158] This aspect of the ICC had more in common with the conferencing system the RFZ installed in the Volkskammer plenary hall than the DSS configuration in the Great Hall. The ICC auditorium did steadily develop a cultural function as a concert venue and it did have technical features specific to this. A proprietary ambiophony system designed by Philips known as the Multi-Channel Amplification of Reverberation System was installed to enhance the reverberation of the venue. The venues share an interesting historical alignment. Opened within three years of each other, both buildings made significant use of asbestos in their construction. This contributed to the Palast der Republik's eventual demolition and the ICC's continued dereliction, although the fate of the Palast der Republik was also entangled with the politicking and infrastructural redevelopment of post-unification Berlin.[159] The Great Hall was possibly more audacious than the ICC auditorium in its attempt to technologically address versatile acoustics, albeit with a varied degree of success, and the RFZ used DSS as a means to proselytise new acoustic possibilities and its own research capability. Despite the Palast der Republik and DSS preceding the ISS by several years, the West German venue was the RFZ's most frequent point of reference as it publicised DSS as a commercial product and attempted to become a significant supplier of distributed sound systems for diverse uses.[160]

DSS underwent continued development and refinement during the 1970s and 1980s as the RFZ sought to capitalise on its proprietary innovation.[161] One of the greatest successes of this policy was the installation of a DSS system at the Palace of Culture in Prague in 1981. The Palace of Culture is smaller than the Great Hall, with about 3,000 seats over two levels. Its layout was more conventional, but it had similar multi-purpose intentions. Popular music events were planned to make up 40% of the annual programme, with orchestral concerts taking

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[158] Ahnert and Steffen, 252.
[159] Carol Anne Costabile-Heming, 'The Reconstructed City Palace and Humboldt Forum in Berlin: Restoring Architectural Identity or Distorting the Memory of Historic Spaces?', *Journal of Contemporary European Studies* 25, no. 4 (2017): 446, https://doi.org/10.1080/14782804.2017.1361816; Katja Reichgardt, 'Wieder große Pläne für das ICC', *Berliner Abendblatt*, 27 June 2018, http://www.abendblatt-berlin.de/2018/06/27/wieder-grosse-plaene-fuer-das-icc/.
[160] Steinke, 'Delta Stereophony - A Sound System with True Direction and Distance Perception for Large Multipurpose Halls', 500; Gerhard Steinke et al., 'Das-Delta-Stereofonie-System: Teil 1', *Radio Fernsehen Elektronik* 36, no. 10 (1987): 616.
[161] 'Elektroakustische Einrichtungen für den Palast der Republik Vorbemerkungen' (Rundfunk und Fernsehtechnisches Zentralamt, 1976), Deutches Rundfunk Archiv.

up a much smaller proportion of the production calendar.[162] The ambiophonic system installed at the Palace of Culture is noteworthy for being an assisted resonance system, similar to what was installed in the Royal Festival Hall during the 1960s.[163] This departure from the approach used at the Great Hall was viewed as the safest solution for enhancing reverberation without colouring the sound.[164] After the system had been in place in Prague for several years, representatives of the Palace of Culture and the Radio and TV Research Institute, Prague, presented a paper to the 1985 AES conference on their experiences running the system.[165] They admitted that there had been some reticence among the venue's technical staff towards the system's level of sophistication.[166] This was the motivation behind a provision that allowed technical staff to switch the system to monophonic use, bypassing the DSS processing. The venue and its technical staff overcame their doubts and endorsed the system and its contribution to good sound localisation in the auditorium.[167] Visiting sound engineers continued to be occasionally alienated by the system's complexity. In particular, visiting rock bands touring their own stereo tower systems often hooked into the DSS in its mono configuration for the sake of simplicity.[168] The Prague installation included the facility to use one of DSS's most sophisticated capabilities: the active panoramic regulator. Regularly highlighted by the RFZ in DSS literature, the panoramic regulator referred to a facility whereby a sound engineer could actively track a moving sound source across the stage, with the system then distributing the signal to reproduce the physical movement in the sound field.[169] The feature was infrequently used in Prague but continued to be promoted by the RFZ and was utilised for site specific theatre productions.[170]

During the 1980s, DSS was used across Europe as the sound reinforcement system for a wide variety of theatre and television productions and several permanent installations.

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[162] Z. Kešner and V. Minarik, 'Experience over Five Years with the Deltastereophony System in Palace of Culture in Prague', *Audio Engineering Society Preprint* 77 (1985): 2.
[163] Ahnert and Steffen, *Sound Reinforcement Engineering*, 266.
[164] Ahnert and Steffen, 266.
[165] Kešner and Minarik, 'Experience over Five Years with the Deltastereophony System in Palace of Culture in Prague'.
[166] Kešner and Minarik, 9.
[167] Kešner and Minarik, 4.
[168] Kešner and Minarik, 9.
[169] Steinke, 'Delta Stereophony - A Sound System with True Direction and Distance Perception for Large Multipurpose Halls', 501.
[170] Kešner and Minarik, 'Experience over Five Years with the Deltastereophony System in Palace of Culture in Prague', 7; Wolfgang Hoeg and Peter Fels, 'Weiterentwicklungen und neuere Anwendungen des Delta-Stereofonie-Systems im mobilen Bereich der Beschallungstechnologie', *Technische Mitteilungen des RFZ* 32, no. 4 (1988): 77.

Projects in Western Europe included an open-air theatre production at the Festspielhaus Bregenz in Austria and another open-air production at the Freilichtbühne Trachselwald in Switzerland.[171] Prominent Eastern Bloc projects included the upgrading of the Kremlin Palace and the Semperoper Dresden.[172] Given the continuing political alienation between East and West Germany during this period, uses of DSS in West Germany are particularly noteworthy. DSS demonstrated a startling circularity when it was trialled during January 1988 for Sender Freies Berlin in Sendesaal I at Haus des Rundfunks; where Hans Buttenberg had developed the original concept of delta stereophony during the early 1950s and the former home of Rundfunk DDR's and the RFZ's predecessor organisations.[173] This trial was facilitated by a formal export arrangement between the RFZ and the West German Firma Dudda.[174] Although Sender Freies Berlin did not pick up the system, it was installed in a new regional venue in West Germany in 1989. This was the STADEUM Cultural and Conference Centre in Stade, 60 km from Hamburg.[175] The Stade installation demonstrates DSS's continued application to venues with diverse cultural programmes, but also a trend that defined DSS technologically during the 1980s. As early as the Prague installation in 1981, DSS hardware was increasingly sourced from non-GDR manufacturers. The original DSS installation in the Great Hall was upgraded in 1986 and the main system was replaced with US-made Meyer Sound Lab UPA 1A loudspeakers powered by low-impedance Meyer amplifiers, supplied through Firma Dudda.[176]

The RFZ's role with DSS installations increasingly took the form of consultant. The Stade acoustic design was led by Elmar Maronn from Hamburg and the technical installation was overseen by Siemens with support from the RFZ DSS team.[177] The technical hardware used at Stade had diverse national origins and included Siemens amplifiers, ElectroVoice DML 1122 loudspeakers and a Harrison mixing desk.[178] However, the RFZ was continuing to

[171] Ahnert and Steffen, *Sound Reinforcement Engineering*, 336; Hoeg and Fels, 'Weiterentwicklungen und neuere Anwendungen des Delta-Stereofonie-Systems im mobilen Bereich der Beschallungstechnologie', 79.
[172] Ahnert and Steffen, *Sound Reinforcement Engineering*, 366, 384.
[173] Gerhard Steinke, 'Stereo-Ambiofonie und Delta-Stereofonie - zweit Mittel zur Optimierung, denn: Der Raum ist das Kleid der Musik', in *Leben für den guten Ton: Kolloquium anlässlich des 90. Geburtstags von Gerhard Steinke* (VDT Seminar, Berlin: Verband Deutscher Tonmeister, 2012), 179.
[174] Gerhard Steinke and Gisela Herzog, *Der Raum ist das Kleid der Musik: Musik-Aufnahmesäle und Hörspielstudios im Funkhaus Berlin-Nalepastrasse sowie weitere Aufführungs- und Hörräume* (Berlin: Verlag Kopie & Druck Adlershof, 2012), 178.
[175] Gerhard Steinke, Peter Fels, and Wolfgang Hoeg, 'The Delta Stereophony System (DSS) in the City Hall Of Stade and in the Open-Air Theater Trachselwald', *Audio Engineering Society Preprint* 88 (1990).
[176] Ahnert and Steffen, *Sound Reinforcement Engineering*, 358; Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 178.
[177] Gerhard Steinke, Peter Fels, and Wolfgang Hoeg, 'Das Delta-Stereofonie-System (DSS) im neuen Kultur- und Tagungszentrum STADEUM', *Technische Mitteilungen des RFZ* 34, no. 3 (1990): 57–63.
[178] Ahnert and Steffen, *Sound Reinforcement Engineering*, 369.

develop new hardware to improve DSS. The Prague installation utilised AKG delay units and this relationship developed into a close collaborative one. The Austrian company became a partner in the commercialisation of DSS and led the development of a hardware controller, the DSP 610.[179] This hardware unit was designed to improve the flexibility of DSS by handling the audio delay and distribution centrally and make it independent of standalone audio delay units.[180] The DSP 610 was the last major feature added to DSS, but production problems limited its distribution.[181] While the progressive absence of GDR-manufactured technical equipment in DSS installations during the 1980s was indicative of shortcomings in the GDR audio industry, it also speaks towards the validity of the underlying system and the RFZ's ability to form international technical relationships to maintain its viability. DSS was a proprietary design approach to sound reinforcement, which the RFZ could offer as the basis for developing bespoke solutions for managing sound in large or unusual venues and performance contexts. The centralised character of the design and construction of the Great Hall and DSS was typical of project management in the GDR, but it was unusual in the context of commercial sound reinforcement in the West. However, the RFZ was able to adapt to the Western commercial model by finding key partners to supply system components that it could not and to act as Western European representatives for DSS. This approach was sufficient to establish a commercial presence for DSS across Europe during the 1980s.

The fall of the Berlin Wall augured the dissolution and assimilation of East German broadcasting institutions into a pan-German service modelled on the West German federal system. In March 1990 the RFZ presented a paper on the Stade DSS installation at the AES conference in Montreux, before Rundfunk DDR was folded into the West German broadcasting apparatus and the RFZ was disbanded.[182] In 1996 a paper written by Peter Fels – a contributor to the later development of DSS - published by the AES commemorated twenty years of DSS and updated the status of the system and its continued availability.[183] Recent installations included a system at the Adler Planetarium in Chicago.[184] Fels' paper indicates that the rights

[179] Steinke et al., 'Das-Delta-Stereofonie-System: Teil 1', 616.
[180] Steinke, Fels, and Hoeg, 'The Delta Stereophony System (DSS) in the City Hall Of Stade and in the Open-Air Theater Trachselwald', 7.
[181] Steinke, Fels, and Hoeg, 'Das Delta-Stereofonie-System (DSS) im neuen Kultur- und Tagungszentrum STADEUM', 7.
[182] Steinke, Fels, and Hoeg, 'The Delta Stereophony System (DSS) in the City Hall Of Stade and in the Open-Air Theater Trachselwald'.
[183] Peter Fels, '20 Years of the Delta Stereophony System - High Quality Sound Design', *AES 101st Convention* 100 (1996): 1–13.
[184] Fels, 11.

to the DSS license were by then held by the telecommunications company Deutsche Telekom. The rights were inherited by the company when it was formed in 1995 by the privatisation of the formerly state-owned West German Deutsche Bundespost, which had previously absorbed the East German Deutsche Post in 1990. Interest in DSS dwindled as new trends in sound reinforcement, such as line source arrays, began to dominate.[185] However, DSS continued to be influential, notably through the work of one of its contributors, Wolfgang Ahnert. In 1990, Ahnert founded a private consultancy, Acoustic Design Ahnert, and applied his experience with DSS to new projects.[186] Ahnert's consultancy was successful and he was involved with the 1992 redesign of the Berliner Philharmonie's mono loudspeaker cluster, where he used a DSS-type mixing matrix in the system design.[187] In this way, the lifetime of DSS extended somewhat beyond that of its original home.

4.7 Conclusion

The socialist-inspired design principles that resulted in the unusual pairing of a parliamentary house and a publically accessible civic "palace" at Palast der Republik also found expression through the design of the Great Hall. This emerges most clearly in the venue's combination of scale and flexibility, which was unprecedented in Germany. Many elements of the Great Hall broke with traditional venue design conventions and the solutions this required in terms of the creation of its acoustic were bespoke and highly technical. The operating principles and technical execution of DSS married internationally developed theories with a natively developed methodology and integrated the best-available GDR sound technology with key components from abroad. The conceptual work of the RFZ on DSS confirmed the ability of that organisation to envisage new potentialities and to deliver practical solutions. The improvement of DSS during the 1980s using Western audio equipment does place it alongside common narratives of technical decline in the GDR, but also problematises them. The RFZ was able to navigate a viable commercial path for DSS by developing relationships with Western audio hardware companies, promoting DSS in academic discourse and by delivering on installation contracts. DSS methods continued to have relevance in specialised acoustic

[185] 'L-ACOUSTICS - Innovation', accessed 7 October 2018, http://www.l-acoustics.com/about-us-innovation-2.html.
[186] 'ADA Acoustics & Media Consultants GmbH - Corporate Development', accessed 7 October 2018, https://www.ada-amc.eu/116/office/development-of-the-office.
[187] Ahnert and Steffen, *Sound Reinforcement Engineering*, 382.

applications for some years after the end of the GDR and the demolition of the Palast der Republik and the Great Hall.

DSS and the Great Hall also offer a perspective on the interplay between performance acoustics, politics and technology. The Great Hall's scale, accommodation for diverse use and extreme dependence on new technologies position it as an outlier within the context of other post-war venue designs, but alignments persist. Post-war venues in London, New York, Moscow and West Berlin display similarly tumultuous and incomplete interchanges between politicised attempts to make additional cultural provision for broader publics, historical performance venue conventions and the limits of technology's ability to enhance the design and flexibility of cultural spaces. The GDR had a generalised faith in the transformational power of technology and DSS and the Great Hall pushed at the limits of the capabilities of contemporary sound reinforcement technology in order to broaden the reach of classical music performance.[188] However, this acoustic ambition was best applied to the Great Hall's outreach purposes and did not signal a permanent departure from conventional classical music performance contexts in the GDR. Following on from the Kulturpalast Dresden, the fixed passive acoustic of the 1,900 seat Leipzig Gewandhaus concert hall, built in 1981, was well received. Perhaps of greater note, the lengthy process of securing a "Konzerthaus Berlin" culminated in the restoration of the Preußisches Staatstheater, renamed as the Berliner Sinfonie-Orchester (and known as the Konzerthaus Berlin since 1994) when it was reopened in 1984. The Berliner Sinfonie-Orchester notably shared its lead acoustician with the Great Hall, but Manfred Prasser's vision for the reconfiguration of the war-damaged Preußisches Staatstheater as a dedicated concert hall stands in sharp contrast with his modernist hexagonal Great Hall. Prasser enforced a historicised restoration of Karl Friedrich Schinkel's celebrated 1821 auditorium, a move that suggested that the design of both historically proven and cutting-edge settings for performance could coexist in the GDR's cultural conceptions.[189] Prasser's throwback re-design has been consistently celebrated.[190] Internationally, the uneasy relationship between classical music, opera performance and technological enhancement remains unresolved and under-discussed.[191]

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[188] Thomas A. Baylis, 'Explaining the GDR's Economic Strategy', *International Organization* 40, no. 2 (1986): 385, https://doi.org/10.1017/S0020818300027181.
[189] Susan Doubilet, 'Rebuilt from the Ashes', *Progressive Architecture*, no. 67 (November 1986): 96.
[190] Beranek, *Concert Halls and Opera Houses*.
[191] Anthony Tommasini, 'Microphones Gone, Natural Sound Returns to City Opera', *The New York Times*, 4 November 2009, sec. Music, https://www.nytimes.com/2009/11/05/arts/music/05sound.html; Thompson, *The Soundscape of Modernity*, 324.

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Chapter 5:
System 2000 and Digital Audio Technology in the GDR, 1975-1990

> Das System 2000 ist ein modular gegliedertes System aus Funktionseinheiten und Mikrorechnerbaugruppen auf der Basis höher integrierter Schaltkreise zum Aufbau von tonstudiotechnischen Einrichtungen unterschiedlichen Automatisierungsgrades für die verschiedenen Prozesse (Produktions-, Abmisch- und Abwicklungsprozesse) in Rundfunk und Fernsehen.[1]
>
> System 2000 is a modular system consisting of independent units and integrated circuit-driven microprocessor modules for the construction of audio engineering equipment of varying degrees of automation for the various technical processes (production-, mixing- and mastering-processes) of radio and television.

The restoration of broadcasting in East and West Germany during the late-1940s and early-1950s was largely based on a shared technological foundation of 1930s-era Reichs Rundfunk Gesellschaft (RRG) designs. Surviving pre-war electronics manufacturers, and particularly their ability to manufacture electronic valves, were critical to the recovery of independent consumer and professional audio equipment-making in East Germany. The shared technical heritage between East and West Germany steadily diverged as each nation's broadcasters followed broad technological developments under different circumstances and using different methods.[2] The GDR was relatively unusual - particularly in an Eastern Bloc context - for the degree of technological independence it was able to maintain during the transition from valve- to transistor-based electronics and this facilitated it becoming a significant exporter of consumer electronics.[3] The 1960s saw the Rundfunk und Fernsehtechnisches Zentralamt (RFZ) working synergistically with the GDR's then-expanding electronics industry to develop a transistorised line of audio equipment - System 700 - that provided much of the technical infrastructure for recording and broadcasting in the GDR for

[1] Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000' (Rundfunk und Fernsehtechnisches Zentralamt, 18 January 1982), 4, 31/26/2/7, Deutches Rundfunk Archiv.
[2] Gerhard Steinke and Gisela Herzog, *Der Raum ist das Kleid der Musik: Musik-Aufnahmesäle und Hörspielstudios im Funkhaus Berlin-Nalepastrasse sowie weitere Aufführungs- und Hörräume* (Berlin: Verlag Kopie & Druck Adlershof, 2012), 28.
[3] Bernhard Hein, *Die Geschichte der Rundfunkindustrie der DDR*, vol. 1 (Dessau: Funk Verlag Bernhard Hein, 2002), 115.

almost thirty years.[4] The System 700 line of equipment was successful and reliable, but by the early 1970s, the RFZ was already beginning to conceptualise the GDR's next generation of audio equipment.[5] Recording technology and practice progressed rapidly during the 1970s; recording sessions became more complicated as the number of tracks that could be simultaneously recorded to tape steadily increased. Towards the end of the 1970s, private audio companies in the US began to make innovative use of industrial automation principles to manage large recording desks and complicated sessions.[6] As digitally-controlled automation in the US rapidly improved, its application to analogue recording processes quickly became an accepted part of high-end audio recording. From around 1975 the RFZ began to actively seek a path towards adopting automation and digitised approaches for managing audio.[7] In the early 1980s, this led to the commencement of the System 2000 project.

The inclusion of digital technology elements in the System 2000 schema made it a historically significant technological progression for the RFZ, at least equal in magnitude to the valve/transistor crossover it had previously navigated and substantially more research-intensive. System 2000's digital elements set it against the backdrop of large-scale efforts to develop GDR information technologies during the 1970s and 1980s. From as early as the 1960s, one of the enduring characteristics of the IT industry in the GDR was a degree of disconnect between politically-directed technological goals and the impact the resulting technologies actually had on reforming conditions within the GDR itself.[8] Most of the high-end IT equipment manufactured in the GDR was set aside for export and contributed little appreciable benefit to GDR industry or bureaucratic rationalisation.[9] The RFZ's efforts to create digital audio technologies did coincide with increased efforts to disseminate GDR-manufactured microprocessors and other electronics components among domestically, with the intention of enabling GDR manufacturers and technical organisations to independently self-develop new

[4] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 29; Raymond G. Stokes, *Constructing Socialism: Technology and Change in East Germany 1945-1990*, Johns Hopkins Studies in the History of Technology (Baltimore; London: Johns Hopkins University Press, 2000), 95.
[5] 'Zur Konzeption einer neuen Tonstudiotechnik' (Rundfunk und Fernsehtechnisches Zentralamt, 1971), 31/26/2/3, Deutches Rundfunk Archiv.
[6] Dave Harrison, 'Automation "Dither"', *Recording Engineer/Producer*, April 1977.
[7] Gerhard Steinke, 'Neue Tontechnik Grundinformation: Zur Entwicklungskonzeption einer 3. Generation Tonstudiotechnik' (Rundfunk und Fernsehtechnisches Zentralamt, 6 June 1975), 31/26/2/4, Deutches Rundfunk Archiv.
[8] Dolores L. Augustine, *Red Prometheus : Engineering and Dictatorship in East Germany, 1945-1990* (Cambridge, Mass.: MIT Press, 2007), 265.
[9] Gary Geipel, 'Politics and Technology in the German Democratic Republic, 1977-1990' (ProQuest Dissertations Publishing, 1993), 223, http://search.proquest.com/docview/304029441/?pq-origsite=primo.

equipment and systems to rationalise processes in their respective industries.[10] As major GDR IT organisations like Zeiss and Robotron produced derivative emulations of IBM-type computers that were mostly exported to Eastern Europe, System 2000 is an example of a high-end digital technology that originally had no plans for distribution beyond the GDR. System 2000's primary impetus was to modernise the GDR's own broadcasting, recording and sound reinforcement apparatus in line with international technological developments. System 2000 also contrasts with concurrent development work conducted by the RFZ, due to the degree to which it was dependent on domestic GDR electronics. As elaborated in Chapter 4, the RFZ was able to augment international installations of its DSS sound reinforcement solution using Western audio technology and co-developed a digital processor with AKG. The GDR's leading politician during the 1970s and 1980s, Erich Honecker, actively discouraged joint IT ventures with Western firms, a policy not shared by other Eastern European nations.[11] Additionally, technology export restrictions from the West to the Eastern European Council for Mutual Economic Assistance (Comecon) meant the System 2000 design was almost completely locked-in to the electronics components output of the native GDR IT industry. The RFZ had little recourse when specific components were consistently unavailable other than to rely on its own ability to develop workarounds. General deficiencies with the development and supply of GDR electronics contributed to difficulties with the completion of System 2000 during the late 1980s and were indicative of an impending development ceiling in the GDR IT industry. Similar to other areas of high-tech development, System 2000 hardware did not survive the dissolution of the GDR and the flooding of the Eastern Bloc with cheap and superior-quality electronics components and equipment. However, personnel involved with the System 2000 programme were able to apply their expertise to commercially viable digital audio projects applications in reunified Germany, shortly after the demise of the GDR and the RFZ.

5.1 Valves, Transistors and Automation

By the time the System 2000 project was being first envisaged, the GDR's broadcasting and audio industries had already weathered several major technical challenges and technological transitions. During the immediate post-war period, the first broad challenge they faced was the

[10] James W. Cortada, 'Information Technologies in the German Democratic Republic (GDR), 1949-1989', *IEEE Annals of the History of Computing* 34, no. 2 (2012): 41.
[11] Cortada, 43.

reestablishment of the pre-war technological paradigm. Surviving Reichs Rundfunk Gesellschaft valve-based equipment dating from the 1930s and 1940s was an important contributor to restoration efforts and newly constructed professional and consumer audio equipment in the early post-war years largely followed these designs. The survival of two small former-Telefunken valve factories in Erfurt and Neuhaus am Rennweg is an important example of infrastructural remnants that helped enable the restoration of an independent electronics industry in East Germany.[12] Post-war electronics innovations worldwide initially focussed on improving and miniaturising existing valve designs. While the GDR was not in lock-step with the progress of valve miniaturisation in the West, by 1952 it was producing new series of smaller valves using its own designs.[13] This helped the forerunner of the RFZ, the Betriebslaboratorium für Rundfunk und Fernsehen to design updated valve-based audio equipment during the 1950s, collectively known as System 200.[14] System 200 was an interim design, largely based on RRG heritage-designs, but it had improved components and its smaller dimensions allowed System 200 units to be directly installed into desks - rather than rack-mounted.[15] As Rundfunk DDR consolidated its medium-wave broadcasting network and introduced FM-broadcasting during the 1950s and early 1960s, this was largely enabled by GDR technology and equipment. Rundfunk DDR's first stereo recording desk, as previously detailed in Chapter 3, was a notable exception, with the RFZ relying on the import of some Western components to allow it construct the Mehrkanalregie stereo desk. However, recording desks subsequently installed at Funkhaus Berlin were generally RFZ-designed and constructed with predominantly GDR-sourced components, as Western electronics became increasingly difficult and expensive to procure. The Mehrkanalregie stereo desk was also the last valve-based recording desk installed at Funkhaus Berlin, as transistor technology became ubiquitous during the 1960s.

Transistors – first developed by Bell Labs in the US in 1947 - rapidly eclipsed valves for most electronics applications. They were smaller, more powerful and lent themselves better to mass-scale reproduction. The transformative potential of transistors for organising industry and bureaucracy was tantalising to GDR economic planners and the development of transistor manufacturing in the GDR was prioritised.[16] The US remained for decades the leading

[12] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 1:199.
[13] Hein, 1:201.
[14] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 28.
[15] Steinke and Herzog, *Der Raum ist das Kleid der Musik*.
[16] Augustine, *Red Prometheus*, 265.

innovator and producer of transistors, but close post-war ties aided Western Europe in keeping pace with developments.[17] The introduction of transistors to the GDR began in 1952 at the VEB Werk für Bauelement der Nachrichtentechnik in Teltow, but production did not begin until the mid-50s.[18] It was not until 1963 that the GDR produced more than a million transistors in a year, by which time the US was producing hundreds of millions annually.[19] Production rates of transistors in the GDR did improve during the 1960s and the GDR political apparatus made regular attempts to harness the symbolic value of the increasing availability of the domestically-produced consumer electronics that followed. For the GDR's 20th anniversary in 1969, a commemorative transistor radio with an integrated model of the Berlin Fernsehturm (Berlin TV Tower) on top was issued.[20] Its GDR-specific design belied its dependence on Tesla circuit boards from the Czechoslovak Socialist Republic (ČSSR) due to a lack of domestic components that severely restricted its production run.[21] Nevertheless, successive economic plans did lead to large increases in the production of transistors and this domestic production capability was crucial to the development of consumer and industrial electronics in the GDR.[22] Trade embargos on Comecon countries consistently restricted the export of high-end microprocessors and other electronics components into the Eastern Bloc, stymieing research to an extent, but also enhancing the value of the GDR's efforts to its Eastern Bloc neighbours.[23] The later reversal of this situation following the opening of Eastern European markets to Western imports was impactful to the viability of System 2000 during its latter stages.

Political directions by the SED during the early 1960s helped coordinate and develop the GDR's electronics industry and the resulting improvement in domestic supplies of transistors and other electronics components facilitated the RFZ's development and construction of a conceptually integrated system of transistor-based modular audio equipment.[24] Known as System 700 and launched at the 1964 Leipzig Messe, System 700 was first installed in Saal 4 at Funkhaus Berlin the same year.[25] System 700 units initially

[17] Raymond G. Stokes, *Constructing Socialism*, 94.
[18] Bernhard Hein, *Die Geschichte der Rundfunkindustrie der DDR*, vol. 3 (Dessau: Funk Verlag Bernhard Hein, 2002), 95.
[19] Raymond G. Stokes, *Constructing Socialism*, 95.
[20] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 3:55.
[21] Hein, 3:55.
[22] Cortada, 'Information Technologies in the German Democratic Republic (GDR), 1949-1989', 39.
[23] Bernhard Hein, *Die Geschichte der Rundfunkindustrie der DDR*, vol. 2 (Dessau: Funk Verlag Bernhard Hein, 2002), 8.
[24] Dieter Hoffmann and Kristie Macrakis, *Naturwissenschaft und Technik in der DDR* (Walter de Gruyter GmbH, 2018), 79; Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 28.
[25] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 107.

incorporated germanium transistors, before transitioning between 1968 and 1970 to silicon-based components.[26] System 700 became the dominant format for recording and broadcasting technology at Rundfunk DDR throughout the 1970s and 80s and was also used in GDR theatres and concert halls.[27] The benefits of transistorised technologies were applied unevenly across GDR industry and society: a focussed effort to develop a highly-integrated circuit for producing one-chip transistor radios resulted in a high-tech gift for delegates of the tenth SED Parteitag in 1981, but public distribution was limited to a few hundred sets in Berlin's hard-currency Intershops.[28] Transistors were a key post-war technology and the independent research activities and technical expertise of the RFZ was central to their steady integration by Rundfunk DDR. While the GDR was not at the forefront in the development of microelectronics, the components it did produce were essential to the RFZ's ability to enable this. System 700 represented a decisive technological break from a shared pre-war German audio technology heritage and confirmed the RFZ's ability to apply new technologies to the requirements of GDR broadcasting and recording. As it approached the integration of digital control technologies to audio, it did so with a track record that was largely successful in executing effective designs that negotiated the inconsistencies of GDR electronics production.

System 700 could be credited with the securing of the technical operability of Rundfunk DDR during the 1960s and 1970s, but, by 1971, the RFZ had already noted audio automation as a rising development trend.[29] Initially, this trend was characterised more by preparatory theoretical work than practical application, but by the mid-1970s US audio companies were starting to integrate digital technologies into sound desks in innovative ways. Music Center Incorporated (MCI) was one of the pioneers in this area. In 1976 MCI released its JH-500 studio recording desk. In 1977 MCI followed this with the JH-50 automation system, which combined with the JH-500 desk to provide a suite of automatable functions that could be used to recall session settings and drastically improve time-efficiency on complicated sessions.[30] A rivalry between MCI and Harrison Consoles amid a generally competitive audio market led to rapid technological leaps in audio automation and the concept was soon standardised in high-

[26] Steinke and Herzog, 107; Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000', 5.
[27] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 107.
[28] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 3:29.
[29] 'Zur Konzeption einer neuen Tonstudiotechnik', 20.
[30] 'MCI's "helping Hands" Automated Mix-Down System', *Recording Engineer/Producer*, February 1977, americanradiohistory.com.

end settings.[31] Each company's methods and digital processes were proprietary but they were emulated with increasing frequency and some general characteristics became common. MCI's JH-50 trendsetting automation system could encode a variety of changes and edits made to a mix in real time by logging them alongside a digital timecode recorded to a dedicated channel on the session's analogue tape reel, effectively synchronising the changes to the music.[32] The recall of audio level changes was made possible by replacing conventional analogue resistive channel faders with voltage-controlled amplifiers (VCAs), which can have their relative values digitally encoded. VCAs were later augmented by moving fader automation, which allow channel faders to physically move autonomously to reflect previous automation passes. Audio automation approaches were diverse, but collectively they introduced a new degree of flexibility in controlling large numbers of audio channels. Audio manufacturers in Western Europe were close behind developments in the US: in 1977 Neve in the UK had its own automation system and Lawo in West Germany had commercial success with its PTR programmable sound desk during the 1980s.[33] Although the RFZ articulated plans for its next generation of audio technology in 1975, it was outpaced by international developments and initially made little material process.[34] An RFZ report from 1982 referred to System 700 and Rundfunk DDR's current technological standing by saying "die Technik nun moralisch verschlissen ist" ("the technology is now morally worn out").[35] Resources began to be assigned towards addressing this situation and a generalised research project tasked with replacing System 700 steadily gained focus and coalesced under the title of System 2000.

5.2 Preparing System 2000

Following on from the pattern established by the RFZ's successful approach towards designing System 700, System 2000 was envisaged as a modular system of audio units constructed using the best available domestic components. In line with a period of audio technology that was characterised by the hybridisation of analogue and digital elements, the audio signal path of

[31] Harrison, 'Automation "Dither"'.
[32] 'JH-500 Series - Professional Mixing Desk' (MCI, 1975), http://www.mcirecording.com/JH-500/JH-500%20Early%20Brochure.pdf.
[33] 'History of AMS Neve', accessed 16 July 2019, http://ams-neve.com/history; 'The History of Lawo', accessed 16 July 2019, https://www.lawo.de/lawo/company/milestones.html.
[34] Steinke, 'Neue Tontechnik Grundinformation: Zur Entwicklungskonzeption einer 3. Generation Tonstudiotechnik'.
[35] Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000', 5.

System 2000 remained completely analogue. However, the main advances and most notable features of System 2000 were the automatable aspects of the system powered by GDR-designed micro-processors.[36] Nonetheless, even the analogue sections of System 2000 were based on completely new designs and achieved marked improvements over System 700-era designs in terms of compactness and energy usage due to the upgraded components. While a project of this type fit the ideological GDR archetype of progression through technology, the RFZ and Rundfunk DDR were more preoccupied with practical concerns. The RFZ believed that the mixing of 16- to 24-track sessions under the time constraints common at Rundfunk DDR had become both physically and mentally unmanageable. In 1982 a bottleneck of 160 un-mixed musical recordings was attributed to this cause.[37] Automation had clear potential to offer substantial long-term benefits, but the RFZ was restricted in its ability to access Western examples. As related in Chapter 2, Deutsche Schallplatten was able to maintain pace with technical recording developments by importing Western audio equipment directly. This policy was effective as Deutsche Schallplatten could allocate hard currency from its international licensing agreements and its technical infrastructure, at its peak, consisted of just five recording studios. Technical upgrades were often applied initially to the Eterna recording studio at the Lukaskirche in Dresden and a single item of upgraded equipment was sometimes enough to ensure that Deutsche Schallplatten's prestige recordings were not superseded by technical recording standards in the West. The scale of Rundfunk DDR's technical infrastructure made enacting a similar policy unfeasible. Rundfunk DDR also did not have an independent supply of hard currency and import restrictions largely ruled out combining GDR components with imported Western components, as was done with the Mehrkanalregie stereo desk in the early 1960s. Although System 700 provided a proven template for the RFZ to develop up-to-date audio technologies, the System 2000 development plan recognised that the research burden of the project was significantly more demanding than previous developments due to its digital and software requirements.[38] The large research commitment demanded by the project could only be justified in the context of long-term development plans for the GDR's audio technology infrastructure; the project's title was not a mere serial number, System 2000 was designed to secure the technological basis for music recording and audio production in the GDR into the next century. An early projection anticipated the production of about thirty full-feature desks between 1995 and 2000, for use across Rundfunk DDR, Fernsehen der DDR, Deutsche

[36] Günther, 5.
[37] Günther, 7.
[38] Günther, 10.

Schallplatten, DEFA, as well as GDR venues.[39] System 2000 was also conceived as providing an important research basis for the generation of audio technology that would follow it, which the RFZ explicitly recognised would be wholly digital.[40]

The scale of System 2000 as a research project and its reliance on GDR microelectronics in unproven capacities meant that collaboration with Eastern European partners was initially seen as a pre-requisite of the project during early planning stages.[41] The ČSSR national electronics producer TESLA was touted as a collaborative partner in both the research and manufacturing aspects of the project and negotiations were initiated, but by 1980 these plans were abandoned.[42] This was attributed to unspecified differences of opinion between the two organisations, but the issue of a shared design for System 2000's chassis and rack mounting system may have been a contributor. The GDR had previously adopted the internationally widespread 19" rack-mount system and was continuing to develop a domestic version of this with its own name and standards: the Einheitliche Gefäßsystem (EGS). TESLA was developing its own ALMES system along similar lines. Although the rack-mount system was one of the more mundane elements of the System 2000 development, issues with the EGS development process impacted the RFZ's preparations. In 1980 an EGS order never materialised and in 1982 it was only through unofficial channels that the RFZ discovered that development of the latest version of EGS had stalled.[43] As a contingency the RFZ designed System 2000 to conform to older EGS standards and similar issues persisted throughout the development period.[44] International collaboration on the System 2000 project was not seriously considered again and the application of System 2000 in settings beyond the GDR was not originally considered integral to the successful execution of the project. The decision not to prepare System 2000 for export had some subsidiary legal implications. Part of the RFZ's standard operations was to monitor international developments and to identify relevant patents so that their own developments wouldn't infringe on international copyright protections.[45]

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[39] Günther, 11.
[40] Günther, 11.
[41] Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000'.
[42] Günther, 2.
[43] Hermann, 'Zum Stand der Entwicklung und Produktionsvorbereitung des Systems 2000' (Rundfunk und Fernsehtechnisches Zentralamt, 29 November 1982), 5, 31/26/1/5, Deutches Rundfunk Archiv.
[44] Schöneberg, Rat, and Sahr, 'Informationsbericht zum Bearbeitungsstand des Themas "Parameter Produktionsanlagen"' (Rundfunk und Fernsehtechnisches Zentralamt, 12 February 1986), 15, 31/26/2/7, Deutches Rundfunk Archiv.
[45] 'Anlage zum Pflichtenheft "Technologisch/technische Grundlagen für Produktionsanlagen im System 2000": Schutzrechtsanalysebericht' (Rundfunk und Fernsehtechnisches Zentralamt, January 1985), 3, Deutches Rundfunk Archiv.

Retaining System 2000 for domestic-usage only had a positive impact on the RFZ's ability to clear international patents for use on System 2000.[46] Even more integral to System 2000 than a consistent chassis standard were the capabilities of the GDR IT and electronics industries; the entire project was predicated on the domestic availability of high-end components and cooperation and assistance from expertise within the GDR.[47] An increasing political focus on the GDR microelectronics industry from the late 1970s and the continuing expansion of the production of transistors and other components during the early 1980s were important factors in making the project appear feasible.[48] Since the 1970s the two largest employers of research personnel in the GDR, Zeiss and Robotron, were both involved with microelectronics.[49] Within cooperative frameworks such as Comecon, GDR information technology significantly narrowed existing technology gaps during this period and was developing computers and servers for commercial use as the System 2000 project was commencing.[50]

The System 2000 research project was fully initiated in September 1981 with the commencement of preparatory training and the design and building of initial hardware components began around the same time.[51] The nature of the technology demanded by the program, heavily reliant on microprocessor technology and computer programming capabilities, was a significant advance on the existing capabilities and experience of the RFZ. Despite the advanced character and broad scope of the project, the RFZ considered itself prepared but under-resourced, describing its existing research capacity as "optimierte, aber weiterhin eingeschränkte" ("optimised, but still limited").[52] The impending demands of System 2000 required significant reprioritisation within the RFZ, particularly after 1982 when it stepped up its own research efforts in the absence of any major collaborative partners. The scope of the proposed research plan and limits on resources led several inter-connected projects to be run in parallel. Peripheral research projects were wound down and the ongoing production of System 700 equipment was curtailed as resources were pivoted towards the new project.[53]

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[46] 'Schutzrechtsanalysebericht', 2.
[47] Walter Hoeg and K. Sahr, 'Zur Einordung des neuen Tonstudiosystems S 2000 in die Generationsentwicklung der Tonstudiotechnik' (Rundfunk und Fernsehtechnisches Zentralamt, n.d.), 31/26/1/5, Deutches Rundfunk Archiv.
[48] Cortada, 'Information Technologies in the German Democratic Republic (GDR), 1949-1989', 35.
[49] Raymond G. Stokes, *Constructing Socialism*, 182.
[50] Gareth Dale, 'Globalism, Microelectronics, and the Demise of the GDR', *Debatte. Review of Contemporary German Affairs* 10, no. 1 (2002): 85, https://doi.org/10.1080/09651560220150495.
[51] Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000', 9.
[52] Günther, 9.
[53] Günther, 2.

Figure 5.1: The APA RBI radio production system in use during the mid-1980s. The system served as a test case for the viability of the development of a sophisticated family of music production equipment.[54]

Computer programming research was prioritised but resource shortages were most apparent in this area.[55] As the project became fully established, initial projections targeted the completion of a full-scale fully-featured production desk for 1988/1989.[56]

System 2000 also had interim targets, largely focussed on radio production.[57] During the mid-1960s Rundfunk DDR went through an expansion period with the opening of a new production block at the Funkhaus Berlin campus and by 1967 the broadcaster had 599 technical employees in Berlin alone.[58] This period was accompanied by generalised rationalisation efforts and the introduction in 1967 of Einmannbetrieb (One-man operation) for the technical production of all national radio programs broadcast from Berlin.[59] System 2000 technology saw its first operational use in radio production as a continuation of these efforts in the early 1980s. Radio production was seen from an early stage as an ideal location for trialling audio

[54] Hoeg and Sahr, 'Zur Einordung des neuen Tonstudiosystems S 2000 in die Generationsentwicklung der Tonstudiotechnik'.
[55] Hermann, 'Zum Stand der Entwicklung und Produktionsvorbereitung des Systems 2000', 5.
[56] Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000', 3.
[57] Günther, 3.
[58] Werner Stankoweit, 'Studiotechnik Rundfunk: Zusammenfassung der Unterlagen über die Entwicklung der Technik des Rundfunks bis 1967, Band II' (Rundfunk DDR, 1967), 407, Deutches Rundfunk Archiv.
[59] Stankoweit, 407.

equipment with digital automation elements. Automating radio production was seen as a modest goal that could be reached by the end of 1984 in a context that was less technically complicated or procedurally risky than Rundfunk DDR's intensive music recording department.[60] There was also the prospect of immediate returns on research investment as the RFZ foresaw large economising potential in applying System 2000 to radio production, predicting a saving of 8000 work hours per year across three national programmes due to enhanced procedural efficiency along with lower maintenance and power costs.[61] The new system also incorporated a move to tape machines that ran at a slower speed - which offered further cost savings by using less tape - and had the potential to be applied to TV production with minor alterations.[62]

The technical equipment developed for radio production work was initially known as the Automatisierte Produktionanlage - Rundfunk Berlin International (APA RBI) and its development was fully integrated with System 2000 research. In 1982 preparatory work on the APA RBI was used as the first opportunity to trial timecode protocols in the GDR.[63] While the GDR had occasionally been slow in developing multi-track tape recorders, the tape machine used for the timecode trials was a domestic design: the R 722/1. The R 722/1 was an important component of System 2000 and it used international SMPTE protocols to interface between itself and the production desk.[64] These early timecode experiments were important preparations for the larger System 2000 desk, which made far more extensive use of automation features. APA RBI equipment - shown in use in Figure 5.1 - had production trials in 1983 and was rolled out across radio production at Funkhaus Berlin over the following years according to a schedule reproduced in Figure 5.2.[65] APA RBI equipment was the first major practical use of System 2000 units and components and it also prompted the first instances of several problems that became characteristic of the larger research project. Supply problems with GDR-made components were frequent. Video monitors and Robotron K 1520 computer components were not delivered.[66] 8-bit digital-analogue switchers required for VCAs were not available domestically; these were imported from Western suppliers at unsustainable expense.[67] Very

[60] Hermann, 'Zum Stand der Entwicklung und Produktionsvorbereitung des Systems 2000', 2.
[61] Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000', 7.
[62] Günther, 7.
[63] Hermann, 'Zum Stand der Entwicklung und Produktionsvorbereitung des Systems 2000', 4.
[64] Hermann, 5.
[65] Hermann, 7; 'Neue Tonstudiotechnik S2000: Präzisierung der Entwicklungszielstellung' (Rundfunk und Fernsehtechnisches Zentralamt, August 1986), 7, 31/26/2/7, Deutches Rundfunk Archiv.
[66] Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000', 11.
[67] Günther, 11.

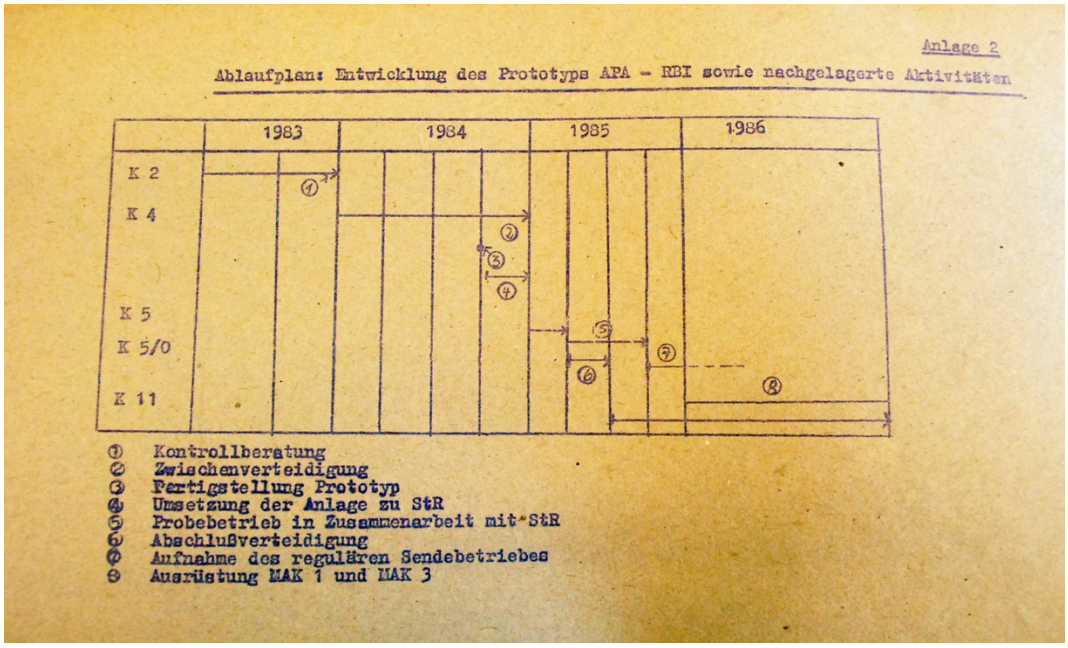

Figure 5.2: A schedule for the roll-out of the APA RBI production system. This schedule was largely adhered to - despite production problems - vindicating the RFZ's internal development model.[68]

significant for the production of APA RBI, and to the basic electronic architecture of System 2000 generally, was the persistent unavailability of operational amplifier components (op-amps).[69] Shortages of this particular component had direct implications for later System 2000 designs.

A distinctive feature of high-end GDR IT research and development during the period of System 2000's development was a reliance on industrial espionage and black market procurement.[70] High-tech GDR IT projects became increasingly reliant on these options to help circumvent shortcomings with its research and development programmes. Such avenues were not available to the RFZ and, apart from occasional opportunistic imports of Western components, it was left to rely on its own ingenuity to bypass the unavailability of fundamental components. Operational amplifiers, or opamps, were required by System 2000 to handle analogue switching in the desk.[71] By the 1980s, due to automated processes, opamps were manufactured in the US in huge quantities at low cost, but those available to the RFZ

[68] 'Schutzrechtsanalysebericht', Anlage 2.
[69] Schöneberg, Rat, and Sahr, 'Informationsbericht zum Bearbeitungsstand des Themas "Parameter Produktionsanlagen"', 14.
[70] Raymond G. Stokes, *Constructing Socialism*, 154.
[71] Schöneberg and Walter Hoeg, 'Parameter Produktionsanalagen S 2000 (Kurzfassung)' (Rundfunk und Fernsehtechnisches Zentralamt, 11 November 1986), 18, 31/26/2/7, Deutches Rundfunk Archiv.

domestically were rejected due to low reliability.[72] The RFZ took the approach of hybridising other available components to function as opamps. At one time, hybrid integrated circuits were seen internationally as a promising avenue in the further development of integrated circuits and they continue to be used for some specific applications.[73] However, they were generally considered obsolete for the purposes to which they were applied in the construction of System 2000. Although the RFZ's hybrid circuits were functionally identical to the opamps they stood in for, by necessity they were larger and heavier than the corresponding monolithic integrated circuit. This contributed to completed System 2000 units being larger and heavier than equivalent Western equipment. However, despite these disadvantages, hybrid circuits were critical to the continuation of System 2000's development.

The APA RBI roll-out across nine radio programmes was conducted between 1985-88.[74] Its development required a large expansion in the RFZ's software development capacity that led to a broad collaboration with TU Dresden that remained important to the System 2000 project.[75] The RFZ was persistent in asking for more in-house research capacity, but out-sourcing collaborations of this type remained the only available form of assistance. The completion of APA RBI desk was seen as the end of the first phase of System 2000 and a vindication of its basic technical and technological concepts.[76] The RFZ was confident about its progress at this point and Gerhard Steinke, one of the most prominent figures within the RFZ, presented a paper on its introduction at the Audio Engineering Society's 1986 conference in Switzerland.[77]

5.3 Tonproduktionanlage System 2000 (TPA S2000)

[72] Schöneberg and Hoeg, 18.
[73] Tapan Gupta, *Handbook of Thick- and Thin-Film Hybrid Microelectronics* (Hoboken, N.J.: Wiley-Interscience, 2003).
[74] Wolfgang Hoeg, Reinhard Adam, and Edmund Steinke, 'S 2000: Ein modulares Tonstudiosystem der digital gesteurten Analogtechnik', *Technische Mitteilungen des RFZ* 34, no. 3 (1990): 56.
[75] Hermann, 'Zum Stand der Entwicklung und Produktionsvorbereitung des Systems 2000', 5.
[76] Sisolefsky and Klaus, 'Qualitätsparameter des Tonkanals in Programmproduktionsanlagen des System 2000' (Rundfunk und Fernsehtechnisches Zentralamt, 30 November 1986), 31/26/2/4, Deutches Rundfunk Archiv.
[77] Gerhard Steinke, 'A New Technical Center for Automatically Controlled International Broadcasting Programmes' (Audio Engineering Society Convention 80, Audio Engineering Society, 1986), http://www.aes.org/e-lib/browse.cfm?elib=5102.

General progress on the development of a large System 2000 system during the APA RBI phase was steady but slow. At the end of 1982, three out of eleven audio hardware projects were nearing completion.[78] The remaining eight were expected to be completed by October 1983.[79] By 1986 the System 2000 project incorporated 75 device types in seven groups.[80] In April 1985 the RFZ's progress was validated by the Staatliches Rundfunkkomitee (State Broadcasting Committee), which directed the RFZ to form a special work group to ensure the completion of System 2000.[81] Most importantly, the committee committed itself as a customer of the project. Further conceptual work was completed by the start of 1986 and the project's focus now tilted towards it primary goal, the design and delivery of a large prototype sound desk for multi-track music recording: the Tonproduktionanlage System 2000 (TPA S2000).[82] The TPA S2000 began to manifest physically in early 1986 with the construction of a prototype multi-fader unit for testing the mixing and group control automation functions.[83] Examples of System 2000 hardware modules are shown in Figure 5.3. While the broad conception and electronic architecture of the TPA S2000 remained relatively stable throughout its development, the exact specification of the intended prototype changed quite frequently. In February 1986 the first prototype was planned as a 24-channel desk, by August this had expanded to 32-channels.[84] A 48-channel "Typ B" configuration was also considered.[85] In addition to 32 input-channels, the desk's design at this point incorporated sixteen outputs to tape and eight control groups. The design was also the first in the GDR to incorporate in-line mixing, a feature for convenient monitoring from tape that became prevalent in music recording during the 1970s.

The TPA S2000 prototype was the pinnacle of the System 2000 research plans and was designed to handle the demands of contemporary music recording sessions with extensive automation features in line with best international practice. Integrating the automation aspects of the desk was one of the most fraught elements of desk's design. The TPA S2000 had several levels to its operational architecture. The most basic of these was the analogue circuitry that

[78] Hermann, 'Zum Stand der Entwicklung und Produktionsvorbereitung des Systems 2000', 5.
[79] Hermann, 5.
[80] Schöneberg and Hoeg, 'Parameter Produktionsanalagen S 2000 (Kurzfassung)', 17.
[81] Schöneberg, Pechardecheck, and Ehrlich, 'Protokoll über die Durchführung einer Verteidigung: Funktionseinheiten Tonkanal I S 2000' (Rundfunk und Fernsehtechnisches Zentralamt, 24 April 1985), 31/26/2/7, Deutches Rundfunk Archiv.
[82] Sisolefsky and Klaus, 'Qualitätsparameter des Tonkanals in Programmproduktionsanlagen des System 2000'.
[83] Schöneberg, Rat, and Sahr, 'Informationsbericht zum Bearbeitungsstand des Themas "Parameter Produktionsanlagen"', 19.
[84] Schöneberg, Rat, and Sahr, 19; 'Neue Tonstudiotechnik S2000: Präzisierung der Entwicklungszielstellung', 4.
[85] Schöneberg and Hoeg, 'Parameter Produktionsanalagen S 2000 (Kurzfassung)', 12.

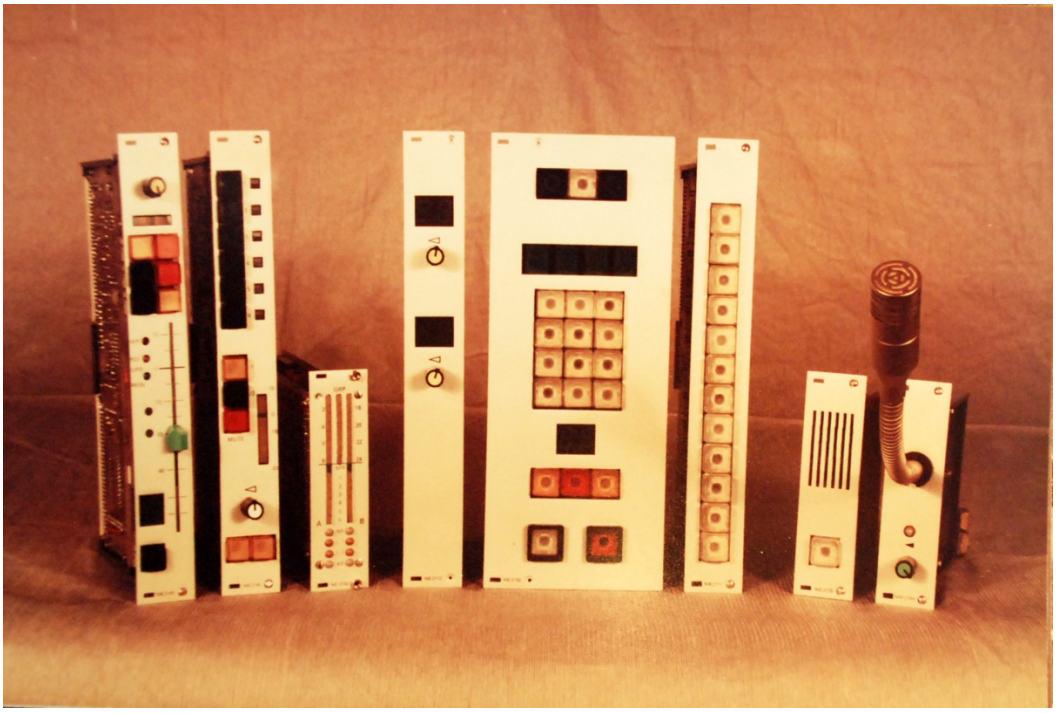

Figure 5.3: A selection of individual System 2000 modules. In line with international approaches, the modules were intended to allow a variety of audio equipment of different scales and application to be constructed using common parts.[86]

handled the audio signal path in a conventional fashion. The next two levels relate to the automatable functions of the TPA S2000, which were split into two categories: static automation and active automation. These were each handled by separate microprocessors. The desk's second level was the integrated Desk Controller powered by an 8-bit micro-processor that handled the desk's static automation.[87] Static automation referred to the desk's ability to recall certain settings - rotating encoders and non-latching switches could have their positions recalled automatically - and routing options.[88] Fader positions could also be reset manually using LED indicators. This offered potential time-savings in the preparation or restoration of recording sessions. The desk's top level was the Mix-computer, based on communication between a 16-bit microprocessor and tape-based timecode to control the desk's active automation functions.[89] Active automation could ease the burden on the engineer during the

[86] 'System 2000 - Bilder' (Rundfunk und Fernsehtechnisches Zentralamt, 1989), 31/26/2/5, Deutches Rundfunk Archiv.
[87] Hoeg, Wolfgang, 'Übersicht der Funktionen des Pult-Controllers für Tonproduktionsanlagen des S 2000' (Rundfunk und Fernsehtechnisches Zentralamt, 20 May 1987), 31/26/2/7, Deutches Rundfunk Archiv.
[88] Sisolefski and Förster, 'Das automatisierte Abmischen mit S2000-Programmproduktionsanlagen' (Rundfunk und Fernsehtechnisches Zentralamt, 19 September 1986), 5, 31/26/2/7, Deutches Rundfunk Archiv.
[89] Hoeg, Wolfgang, 'Übersicht der Funktionen des Pult-Controllers für Tonproduktionsanlagen des S 2000'.

mixing stage by recalling operations made in real-time.[90] The design and construction of the System 2000 digital hardware that powered its static and active automation was largely conducted in-house by the RFZ, but relied on generic GDR micro-processors.[91] The microprocessors were not specialised for the RFZ's purposes and relied on creative programming to make them suitable to their tasks. The availability of these microprocessors was problematic. In 1986 Robotron ceased supplying its K 1520 8-bit chip, but without commencing supply of the succeeding MMS16 16-bit chip.[92] The MMS16 chip was a major milestone for microprocessor development in the GDR and it was particularly important to the System 2000 architecture as the K 1520 8-bit chip used for the TPA S2000's static automation was considered too slow to run the desk's auto-mixing capabilities.[93] The MMS16 also made better provision for future expansion of the desk's automation capabilities, including the possibility of upgrading to automated moving faders.[94] The MMS16 chip was planned to become available to GDR companies in the mid-1980s, but by the end of 1986 the RFZ was still unable to procure it.[95] Delays in securing microprocessors also impacted the RFZ's in-house software development.[96]

As a concession to reliability in the broadcasting arena and to dissuade any distrust of the new digital paradigm, the TPA S2000 could maintain full manual operability if there was a computer failure, but its enhanced utility and the justification for its research and development costs was predicated on the efficiencies derived from its automation capabilities. An estimate from 1985 predicted that System 2000 equipment would cost three time the equivalent System 700 device, but that the added functionality would make it doubly as efficient.[97] Although the TPA S2000's automation features were considered critical to its viability, its independent analogue components were also seen as important for its

[90] Sisolefsky and Klaus, 'Qualitätsparameter des Tonkanals in Programmproduktionsanlagen des System 2000', 12.
[91] Gerhard Steinke, 'Kurze Zusammenfassung der im Jahre 1969 erarbeiteten technisch-ästhetischen und musikalisch-akustischen Probleme' (Rundfunk und Fernsehtechnisches Zentralamt, 11 December 1969), 5, Deutches Rundfunk Archiv.
[92] Sisolefsky and Walter Hoeg, 'Variantenuntersuchung zur Geräte- und Anlagentechnik für Programmproducktionsanlagen S 2000: zum Thema "Parameter Produktionsanlagen S 2000"' (Rundfunk und Fernsehtechnisches Zentralamt, 26 November 1986), 31/26/2/4, Deutches Rundfunk Archiv.
[93] Raymond G. Stokes, *Constructing Socialism*, 170; Sisolefsky and Hoeg, 'Variantenuntersuchung zur Geräte- und Anlagentechnik für Programmproducktionsanlagen S 2000: zum Thema "Parameter Produktionsanlagen S 2000"', 15.
[94] Sisolefski and Förster, 'Das automatisierte Abmischen mit S2000-Programmproduktionsanlagen', 26.
[95] Sisolefsky and Hoeg, 'Variantenuntersuchung zur Geräte- und Anlagentechnik für Programmproducktionsanlagen S 2000: zum Thema "Parameter Produktionsanlagen S 2000"', 15.
[96] Schöneberg and Hoeg, 'Parameter Produktionsanalagen S 2000 (Kurzfassung)', 16.
[97] Schöneberg, Pechardecheck, and Ehrlich, 'Funktionseinheiten Tonkanal I S 2000', 3.

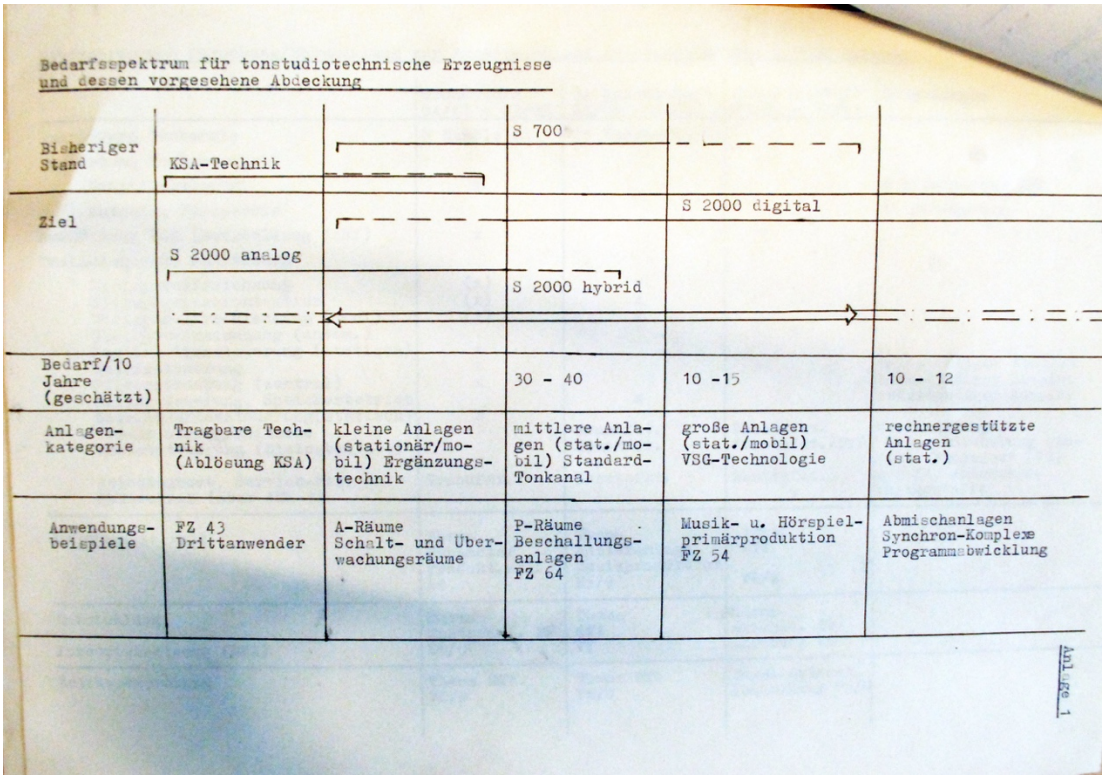

Figure 5.4: A 1985 plan for Rundfunk DDR's migration from System 700 to the various analogue and digital System 2000 configurations. The plan demonstrates the range of uses the new equipment was intended for.[98]

dissemination in the GDR beyond Funkhaus Berlin. System 2000 was intended to guarantee operational security across the GDR's audio industry by providing coverage for all usage areas of sound technology; from recording and broadcast to live sound.[99] The RFZ was also optimistic that System 2000 would appeal to the private music recording studios that were beginning to emerge in the GDR during the 1980s.[100] A universal standard for audio equipment in the GDR had long been advocated by the RFZ and partly achieved during the 1960s and 1970s with System 700.[101] This could be maintained and enhanced by the flexibility and interoperability of System 2000 audio units. This flexibility was also important from an economic point of view; the broad applicability of the system across the various GDR sound industries would validate the large research effort and costs and secure an audio production process for the GDR independent of expensive Western equipment. To enable this wide dissemination, from around 1986 it was proposed that two lines of development would follow on from the first large System 2000 prototype: System 2000 Digital and System 2000

[98] 'Schutzrechtsanalysebericht', Anlage 1.
[99] 'Neue Tonstudiotechnik S2000: Präzisierung der Entwicklungszielstellung'.
[100] Schöneberg and Hoeg, 'Parameter Produktionsanalagen S 2000 (Kurzfassung)', 35.
[101] Steinke, 'Kurze Zusammenfassung der im Jahre 1969 erarbeiteten technisch-ästhetischen und musikalisch-akustischen Probleme'.

Compact.[102] System 2000 Digital would be the full-featured larger-scale product line utilising both digital and analogue units. System 2000 Compact was essentially a more basic line of analogue-only equipment that could directly replace System 700 for purposes that did not require automation – a plan for the staged crossing over of these systems is reproduced in Figure 5.4. These plans for a subsidiary System 2000 line were prone to change year on year, but became of much greater significance to the integrity of the whole project in its latter stages due to external circumstances.

5.4 Rethinking System 2000

While there was optimism within the RFZ during the mid-1980s regarding its progress with System 2000, there were also accompanying reservations. In 1986, Wolfgang Hoeg, an important contributor to System 2000, observed steady improvements in the audio hardware available in West Germany, with the TPA S2000 still several years from completion.[103] Hoeg's observations also led him to a fatalistic observation of the RFZ's ability to surpass System 2000 and to oversee a technological transition to a "fourth generation" digital audio paradigm:

> Der Vergleich des internationalen Entwicklungstandes mit der in der DDR gegebenen materiell-technischen Basis führt auch zu diesem Zeitpunkt zu der Feststellung, daß für das RFZ die Entwicklung einer 4. Generation noch nicht möglich ist, sowie daß der Schritt zur 4. Generation über eine 3. Generation unvermeidbar und notwendig ist.[104]
>
> Comparison of the international state of development with the material-technical base in the GDR leads to the conclusion that at this time the development of a fourth generation is not yet possible for the RFZ, although the step to the fourth generation from the third generation is inevitable and necessary.

There were mixed indicators elsewhere in GDR electronics that year. The GDR radio industry reached a meaningful milestone with the arrival of a dependable integrated circuit, the A 283 D, which allowed the production of large numbers of the GDR's first radio/alarm-

[102] Sisolefsky and Klaus, 'Qualitätsparameter des Tonkanals in Programmproduktionsanlagen des System 2000'.
[103] Schöneberg and Hoeg, 'Parameter Produktionsanalagen S 2000 (Kurzfassung)', 8.
[104] Schöneberg and Hoeg, 8.

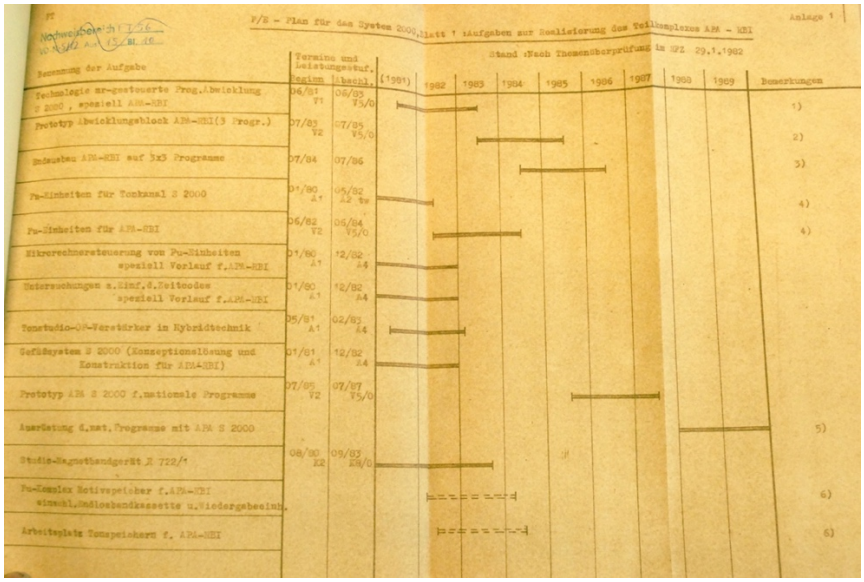

Figure 5.5: A 1982 research and production schedule for the System 2000 project. This schedule envisaged finalisation of the TPA S2000 in 1988/1989. The RFZ's research and development processes were outpaced internationally, but despite major setbacks it was only a year or two behind its own early schedules.[105]

Figure 5.6: The prototype TPA S2000 with missing modules undergoing preliminary trials c. 1989. The desk was approaching completion as political circumstances profoundly altered the context within which it was technologically and economically viable.[106]

[105] Günther, 'Einfuehrungskonzeption zur Entwicklung und Produktion des Systems 2000', Anlage 1.
[106] 'System 2000 - Bilder'.

clock.[107] Hoeg was confident that the TPA S2000 would meet its functional requirements and match the audio standards of the RFZ, but he also acknowledged that it was not likely to match international standards on secondary parameters such as power consumption, weight or size.[108] Hoeg accepted this as a compromise to allow medium-term goals to be achieved in constrained circumstances, but his accurate prediction regarding the development of digital audio in the GDR would be compounded by delays to the completion of the TPA S2000 and political and economic developments that completely altered the specific circumstances within which it was viable.

When the earliest conceptual forms of System 2000 were first mooted by the RFZ during the early 1970s, the organisation could only identify two audio manufacturers that were actively working towards similar forms of audio automation.[109] By 1989 automation was much more commonplace and the RFZ's forward-thinking had been long surpassed by practical progress among a broad range of audio developers in the West.[110] While the reality was that the RFZ was off the pace of international technological developments, it was not far behind its own projected schedule. Early System 2000 project schedules - an example of which is reproduced in Figure 5.5 - predicted a decade-long research process and the completion date for the TPA S2000 remained fairly consistent throughout. This long development schedule meant that the TPA S2000 prototype was approaching its final preparatory phases, while the Berlin Wall was brought down and the GDR's borders to Western Europe were reopened. Within six months, the RFZ was forced to admit "nicht unerheblich auf die Arbeiten an der "TPA S2000" waren die politischer Ereignisse 1989" ("the political events of 1989 were not irrelevant to the work on the TPA S2000").[111] The Wende had broad but uncertain implications for the market position of System 2000. The future role of the GDR's broadcasting apparatus - System 2000's primary customer - was initially undecided. The marketing of System 2000 for foreign export, for years excluded from its development plan, suddenly became critical to new survival plans. At the same time, the currency and embargo conditions that might have made it appealing to Eastern European markets were rapidly dissipating. There were also shortcomings with System 2000 itself; Figure 5.6 shows the incomplete prototype undergoing

[107] Hein, *Die Geschichte der Rundfunkindustrie der DDR*, 2002, 3:30.
[108] Schöneberg and Hoeg, 'Parameter Produktionsanalagen S 2000 (Kurzfassung)', 10.
[109] Schöneberg and Hoeg, 8.
[110] Hoeg, Adam, and Steinke, 'S 2000: Ein modulares Tonstudiosystem der digital gesteurten Analogtechnik', 49.
[111] Schaffner, 'Stand und Probleme bei der Entwicklung des Tonstudiosystems S 2000' (Rundfunk und Fernsehtechnisches Zentralamt, 16 May 1990), 4, Deutches Rundfunk Archiv.

testing during this period. Although the TPA S2000 was close to completion, after a decade of research and development the RFZ could only point to sections of Rundfunk DDR's radio production facility for working examples of its new designs. System 2000 remained an unproven product line that was still being assembled piecemeal by the RFZ's in-house development team and still months or years away from standardised manufacture.

In the months following the Wende, realigning System 2000 to work within hugely altered political and economic circumstances became a major preoccupation of the RFZ. One of the earliest assessments of the new context was a semi-formal one. On 10 December 1989, just weeks after the fall of the Wall, Irmgard Jünger circulated an open letter on the future of the project: *"An alle "Betroffenen": Über die Zukunft des S 2000"*. Jünger had been working on the digital elements of the program since 1987 and her letter was extremely critical of the state of the System 2000 project:

> S2000 wird aber auf Grund mangelnder Forschung/Ergebnis-Kapazität und unzureichender Bedingungen im RFZ (Motivation, Ausstattung, Organisation) mit einem viel zu großen Zeitaufwand entwickelt (absolute Jahre) und wird mit überdurchschnittlichen Anstrengungen in die Produktion eingeführt. Eine absolut mangelhafte Produktionsbasis, der desolate Zustand unserer Volkswirtschaft (selbst lange im Voraus bestellte Bauelemente können mitunter nicht bereitgestellt werden), sowie Bürokratie (viel zu viel Papier) u.v.a.m. führen zu einer unzumutbaren Belastung aller Mitarbeiter, die an der Entwicklung, Produktion und Prüfung der S2000-Geräte und der TPA S2000 beteiligt sind.[112]
>
> S2000, due to deficient research and development capacity and inadequate conditions in the RFZ (motivation, equipment, management), will be introduced after too long a wait (total years) and with unnecessary exertion. An absolutely defective production base, the desolate state of our economy (even long pre-ordered components are sometimes not delivered), as well as bureaucracy (too much paper) and other factors lead to an unreasonable burden on all employees involved in the development, production and testing of the S2000 devices and the TPA S2000.

[112] Irmgard Jünger, 'Über die Zukunft des S 2000', 10 December 1989, 1, 31/26/2/5-31/26/2/7, Deutches Rundfunk Archiv.

Jünger further alleged that delays in the delivery of System 2000 directly led to the import of equipment for a refurbished control room at Funkhaus Berlin.[113] Nonetheless, Jünger believed that the technological basis of System 2000 was sound, even in comparison with contemporary Western equipment, and that it remained an ideal replacement for System 700 equipment throughout the GDR.[114] She also adjudged that System 2000 retained a potential commercial advantage due to currency factors; "eine nach wie vor gültige Tatsache ist, daß dringend automatisierte Tonmischpulte benötigt werden, die man auch für DDR-Mark erwerben möchte" ("a fact that is still valid is that automated mixing desks, which can be acquired for GDR-Marks, are urgently needed").[115] Although System 2000's lengthy and expensive development could not be justified in the new open-market context the RFZ now suddenly faced, the project was close to completion and could still potentially bear positive results.

Jünger's proposals to rescue System 2000 emphasised speed; the research phase needed to be finalised as rapidly as possible in the following months, followed immediately by a move into series production. Jünger specifically advocated the rapid construction of a 16-channel version of the TPA S2000, followed by a second version of the 32-channel prototype by early 1991.[116] A further suggestion was to seek collaborations with Western companies and to research applying the System 2000 digital control system to Western analogue sound equipment.[117] Jünger believed that the project's investment costs, which she estimated at 18 million East German marks, could be recouped and that the project could still produce audio equipment that would be technologically viable for the next ten to fifteen years.[118] However, she judged that the automation features of the TPA S2000 were only of use to a small proportion of potential end-users and that the RFZ needed to develop a parallel series of fully-analogue equipment using the System 2000 standards.[119] As previously cited, this was already nominally a part of the long-term System 2000 plan under the label of System 2000 Compact. Somewhat side-lined by an overriding focus on completing the TPA S2000, this simplified

[113] Jünger, 1.
[114] Jünger, 1.
[115] Jünger, 1.
[116] Jünger, 2.
[117] Jünger, 2.
[118] Jünger, 3.
[119] Jünger, 2.

analogue-only line, now referred to as System 1000, was reemphasised in all System 2000 strategic plans from this point onward.

In 1985, the RFZ estimated that the unit cost of the full-scale TPA S2000 would be two and a half times the price of an equivalent Western system.[120] This could be justified within the context of a closed market, but System 2000 no longer had this protection. Since the time of the abortive TESLA collaboration in the late 1970s, exporting System 2000 ceased to be considered as a factor in its economic viability. Post-Wende, all visions of System 2000's survival relied on the assumption of foreign sales to Western and Eastern Europe. Official RFZ responses to the Wende shared some of Jünger's optimism while recognising the scale of the challenge. All official RFZ assessments of the state of System 2000 emphasised speed of completion as a priority in its survival. In January 1990, a report by Wolfgang Hoeg suggested the magnitude of the price adjustment required to make the system marketable. Hoeg proposed that commercial viability for System 2000 could be achieved if it was rapidly reconfigured for broader usage and with a manufacturing cost reduced by 60%.[121] Hoeg also echoed Jünger's assertions that the large TPA S2000 was a niche product; System 2000 needed to be available in several configurations to service a broad range of demands. Hoeg submitted outlines for reconfiguring System 2000 modules into several small and medium-scale production desks.[122] The largest of these was 24-channels and still boasted automated features. The rest were smaller designs that used System 2000 modules but without the digital control components in an attempt to appeal to more general audio customers.[123] Although these simplified designs were within the capabilities of the RFZ's design team, they still needed additional development time during a period of rapid upheaval. Hoeg's long list of proposed methods for reducing the development time needed by these new designs and for achieving the drastic reductions in manufacturing costs can also be read as an implicit criticism of development procedures up until that point.[124] Of significance to Hoeg's contingency plans was finding out whether the Staatliches Rundfunk Komittee still wanted to follow through on its order for a second TPA S2000, as this would impact the turnaround of the development of new equipment designs.[125]

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[120] Schöneberg, Pechardecheck, and Ehrlich, 'Funktionseinheiten Tonkanal I S 2000', 4.
[121] Wolfgang Hoeg and K. Sahr, 'Rahmenkonzeption für die Entwicklung kleiner und mittlerer Tonstudioanlagen im System S 2000' (Rundfunk und Fernsehtechnisches Zentralamt, January 1990), 13, 31/26/2/5, Deutches Rundfunk Archiv.
[122] Hoeg and Sahr, 'Rahmenkonzeption für die Entwicklung kleiner und mittlerer Tonstudioanlagen im System S 2000'.
[123] Hoeg and Sahr, 4.
[124] Hoeg and Sahr, 8.
[125] Hoeg and Sahr, 13.

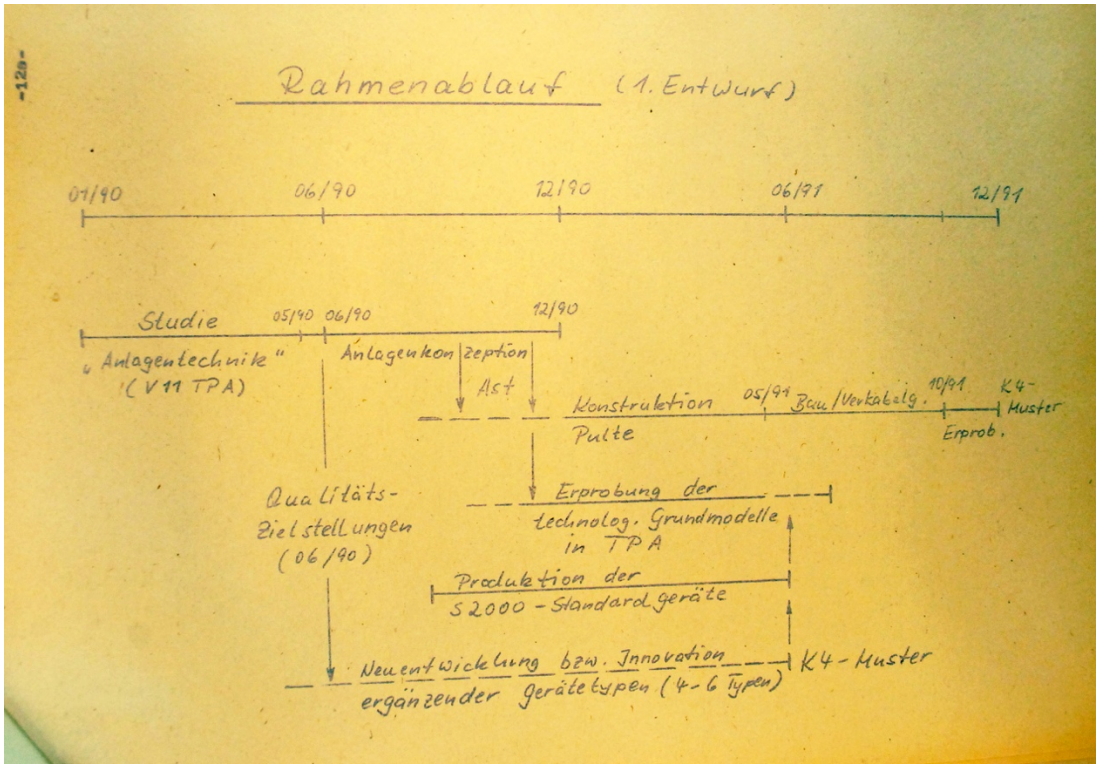

Figure 5.7: A contingency development plan for System 2000 c. January 1990. Significant efforts were expended on maintaining the viability of System 2000 during the early period of the Wende, but these were materially unfruitful.[126]

Hoeg perceived the time-sensitivity of his plans and wanted a firm outcome on the matter within a month. There was also a degree of uncertainty around the future of the existing TPA S2000 prototype and its availability for further testing.[127] This desk was intact and functional at this point, but it was still not fully complete or ready for operational use. Irmgard Jünger was of the view that the TPA S2000 prototype was not fit for sale due to design issues and that it should be retained by the RFZ as the basis for improved designs.[128]

Throughout 1990, the RFZ worked under the new principle of preparing System 2000 for export. System 2000 was regularly featured in the RFZ's technical journal and by May the RFZ was still publishing reports that depicted workable outcomes within the emerging commercial context.[129] The RFZ considered the international market for well-designed

[126] Hoeg and Sahr, 'Rahmenkonzeption für die Entwicklung kleiner und mittlerer Tonstudioanlagen im System S 2000'.
[127] Hoeg and Sahr.
[128] Jünger, 'Über die Zukunft des S 2000', 10 December 1989, 2.
[129] Hoeg, Adam, and Steinke, 'S 2000: Ein modulares Tonstudiosystem der digital gesteurten Analogtechnik'; Reinhard Adam and Rolf Kratzsch, 'S 2000: Gerätesortiment und analoge Schaltungstechnik des neuen DCA-Tonstudiosystems', *Technische Mitteilungen des RFZ* 34, no. 4 (1990): 73–79.

analogue desks to be buoyant and particularly wanted to target West German broadcasters as customers.[130] Emphasis remained on reducing the price-point by about 50% from pre-Wende estimates.[131] Cheap components newly available from the West were thought to be potentially beneficial to turning around the multiple new System 2000 derivatives, but none of these designs progressed much further than the drawing board and revised development schedules still extended well into 1991 – as illustrated in the diagram reproduced in Figure 5.7.[132] Independent of its own efforts, the RFZ's parent company, Deutsche Post, began to consider spinning off sections of the research organisation into limited companies.[133] This was seen as a possible route to capitalising on the RFZ's research and bringing the new System 2000 designs to market, potentially in collaboration with West German partners. Even as the order for the second TPA S2000 was cancelled by the Staatliches Rundfunk Komittee, the RFZ claimed it was identifying potential new customers: the Goldener Löwe private recording studio in Leipzig, Funkhaus Dresden and Funkhaus Weimar.[134] The focus on targeting West German broadcasters continued in June 1990 with new plans for a radio production desk.[135] Referred to as the NZ 2131 and much simpler in scope than the TPA S2000, its design was primarily analogue but allowed for the addition of centrally controlled static automation features as an optional extra.[136] The design of the NZ 2131 implicitly references the RFZ's new internationalist focus by marking the organisation's return to applying international DIN standards.[137]

Despite pressing through with new designs and proposals during the summer of 1990, there were increasing signals that System 2000 would not survive the ongoing political and economic upheaval. While the project's survival plan now relied largely on a repositioning towards the international market, the RFZ continued to canvas domestic demand. Rundfunk DDR's own technical procurement department, Studiotechnik Rundfunk, prevaricated about System 2000's future role with the broadcaster;

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[130] Schaffner, 'Stand und Probleme bei der Entwicklung des Tonstudiosystems S 2000', 3.
[131] Schaffner, 5.
[132] Schaffner, 4.
[133] Schaffner, 7.
[134] Schaffner, 10.
[135] K. Sahr and Walter Hoeg, 'Hörfunk-Programmabwicklungsanlage NZ 2131: Technologische und anlagentechnische Konzeption (Stand: 06/90)' (Rundfunk und Fernsehtechnisches Zentralamt, 18 June 1990), Deutches Rundfunk Archiv.
[136] Sahr and Hoeg, 8.
[137] Sahr and Hoeg, 10.

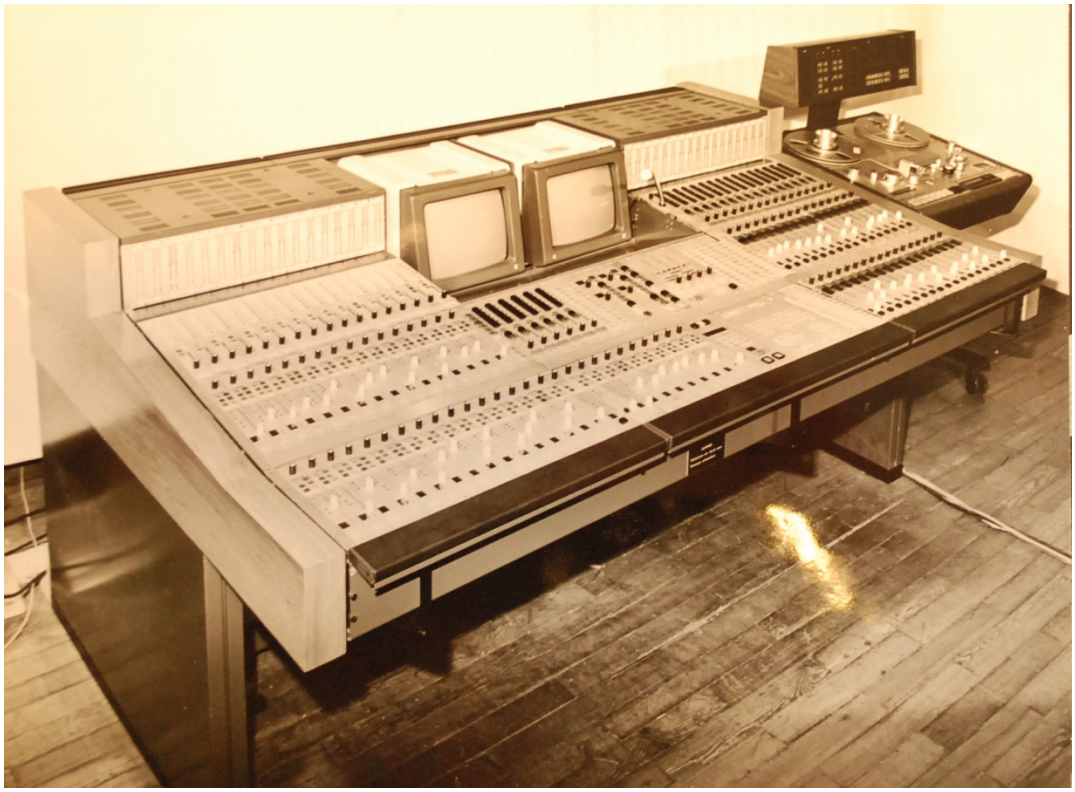

Figure 5.8: The completed prototype TPA S2000 before its destruction around 1990/1991. The process of the Wende saw the infrastructure and personnel of Rundfunk DDR rapidly absorbed and reconfigured under West German organisational structures.[138]

> Aufgrund der bevorstehenden Profilierung des Rundfunks als öffentlich rechtliche Anstalt vor dem IV. Quartal 1990 keine Aussagen zum Bedarf an tonstudiotechnischen Geräten und Anlagen getroffen werden können.[139]
>
> Due to the pending profiling of broadcasting as a public-law institution before the fourth quarter of 1990, no statements can be made about the demand for audio-visual equipment and systems.

A similar attitude prevailed elsewhere within Rundfunk DDR. The technical director at Funkhaus Dresden declared that they were not interested in engaging with System 2000, even though they were planning to move to a new facility in 1991.[140] The response from outside the broadcasting industry was also negative. The technical director of the Sport und Kongresshalle, Rostock wrote,

[138] 'System 2000 - Bilder'.
[139] Preiß, 'Preiß to Schaffner', 10 April 1990, 31/26/2/5, Deutches Rundfunk Archiv.
[140] Schlaack, 'Schlaack to Schaffner', 20 April 1990, 31/26/2/5, Deutches Rundfunk Archiv.

> Wir können auf Grund der Situation im Land zur Zeit keinen Bedarf für Tonstudioanlagen S 2000 anmelden da für unsere Einrichtung keine Konzeption für die künftige Nutzung vorliegt."[141]
>
> Due to the situation in the country at the moment, we are unable to register any demand for sound desk S 2000, because our establishment possesses no concept for its future utilisation.

In the end, System 2000 suffered a similar fate to what befell large swathes of Rundfunk DDR's technical broadcasting infrastructure, as GDR broadcasting was folded into the West German broadcasting network and parallel infrastructures judged to be redundant were shut down.[142] The specialised attributes of Funkhaus Berlin and the functional potential of System 2000 became swiftly irrelevant and former-RFZ personnel were left to advocate their expertise outside of state structures. The completed TPA S2000 prototype – shown in Figure 5.8 - was destroyed during a period that saw much of the technical equipment of Funkhaus Berlin removed from the defunct broadcasting facility.[143]

5.5 Conclusion

Over the course of its lifetime, Rundfunk DDR succeeded in expanding its recording and broadcasting capacity to serve a large national audience. This was supported in large part by the design and manufacture of reliable audio equipment by the RFZ (and its predecessor, the BRF), along with other GDR audio manufacturing companies. The RFZ was able to observe and predict technological trends over decades and consistent leadership allowed it to enact long-term research projects that shadowed emerging technologies from the West. The research methodologies that realised the adoption of transistorised technology at Rundfunk DDR during the 1960s and 1970s were applied to the next generation of audio technology upgrades during the 1980s. Although the development of System 2000 was slow, its capabilities were probably sufficient to secure the viability of GDR sound and broadcasting technology for another decade.

[141] Genoch, 'Genoch to Schaffner', 8 May 1990, 31/26/2/5, Deutches Rundfunk Archiv.
[142] Steinke and Herzog, *Der Raum ist das Kleid der Musik*, 14.
[143] Steinke and Herzog, 33.

However, it was not technologically appealing or cost effective outside the particular economic situation of the Eastern Bloc and this was exposed almost instantaneously once borders restrictions began to dissipate in 1989. Sentiment within the RFZ also indicated that the GDR did not have resources adequate to developing an infrastructure for handling the impending migration to digital audio. This forthcoming constraint resembled more immediate limitations within the GDR's IT industry. The unveiling of a GDR-constructed 1 MB microprocessor in 1988 was trumpeted by the state apparatus, but this masked the extent to which the chip lagged behind contemporary Western components and the inability of the GDR IT industry to realistically mass-produce it.[144]

Technology developments in the West could rely on both the massive electronics output of multiple major multi-national corporations and the synergistic activities of smaller private companies that found application for these electronics in diverse specialised fields, as seen with audio automation during the 1970s. While the RFZ performed an analogous role to these private companies within the GDR's research structure, its capacity to do so was constricted. An inescapable shortage of essential materials for the System 2000 project - alongside the political and economic circumstances that accompanied it in its latter stages - mitigated against its systematic introduction and precludes the possibility of making a definitive assessment on its technical viability. Nevertheless, the project demonstrated resourcefulness and its application could have been a counter-example to the low penetration of applied digital technologies in GDR industry.[145] Despite considerable levels of uncertainty during the final days of the GDR, the RFZ and its workers remained committed to the System 2000 concept and worked to make it feasible within a drastically altered set of circumstances. While this effort failed, the experience and expertise of the System 2000 design team found new outlets after the Wende. Wolfgang Hoeg, a significant figure in the design of System 2000, brought his expertise to Neumann and was later also instrumental in the success of the sound technology company Stage Tec. Founded in 1993, Stage Tec specialises in digital audio hardware and developed a reputation for high-end digital sound production desks.[146] Irmgard Jünger also found commercial application for her expertise in digital audio as a co-founder of Jünger Audio-Studiotechnik.[147] These outcomes again mirror some aspects of the fallout from the

[144] Raymond G. Stokes, *Constructing Socialism*, 191.
[145] Cortada, 'Information Technologies in the German Democratic Republic (GDR), 1949-1989', 43.
[146] 'STAGE TEC Company Profile', accessed 9 August 2018, https://www.stagetec.com/en/stagetec/stage-tec.html.
[147] 'Jünger Audio - Corporate History', accessed 31 July 2018, https://junger-audio.com/en/corporate.

GDR IT industry and other research areas of the RFZ. While high-tech hardware manufacturing largely failed to survive the economic convulsions of the Wende, software designers and other specialised workers from the GDR's leading technology areas found ready applications for their skills during the early 1990s by forming their own companies or joining existing West German enterprises.

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Conclusion:

At root, this thesis is an attempt to analyse how GDR politics and social realities emerged in its audio technologies and infrastructures. During the early stages of research a pressing question was whether it would even be possible to detect clear political threads in audio technology equipment and processes and make practical interpretations from these. In practice, the degree to which this area opened up to focussed investigation was extensive and profound. Traces of the GDR's ideological stances, economic position and social currents are legible at every level of audio activity and during every period, undeniably colouring technological transitions, infrastructures and processes. Some of the traces discussed impacted in subtle ways that are open to interpretation, but more often these interactions of technology and political and economic conditions contributed appreciably to the form and methods of many undertakings. These were active processes taking place across many sections of the GDR's audio communities and supporting industries. Although this thesis looks at a number of specific cases, a sense of developments and progressions over a wide range of time and technical contexts is given. The work of this thesis was achieved by following in directions indicated by the archival sources left by the GDR's own institutions. Investigations coalesced around a small number of case studies that encompass a number of evocative technological stress points distributed across the GDR's timeline and several of its major audio institutions. While archives provided the centres of focus and a solid grounding for much of what is contained here, engaging with the broader activities of some the GDR's primary audio institutions, accompanying contemporary rhetoric and wider international technological contexts led to surprising alignments and some significant findings.

The contribution of this thesis in a general sense is a contextual enrichment of GDR studies by providing some new case studies in areas that have not been fully incorporated into the field. Expansion in this broad area of study remains relevant. GDR history has had complicated developments of interpretation that are still ongoing, but its significance to understanding the history of Europe in the latter half of the 20th century is not in dispute and requires continued engagement with new techniques and approaches. The case studies of this thesis cover a large sweep of time and several distinct, if interrelated, areas, but they offer a broader view into cultural technologies and the GDR entity than may be supposed from the relatively narrow snapshot each singly offers. While the large trajectories that form the

backdrops to these specific studies have been described elsewhere, the work offered here contributes some finer detail and also contributes new angles of relief on the political and social dynamics of the GDR. The incorporation of new primary material facilitated new analyses and while the subject matter is often technical and technologically focussed, it should still be of interest and assistance to GDR historians of various, particularly culturally focussed, specialisms. Beyond this, these individual case studies deal with undertakings that mirror those taking place elsewhere and may be helpful to investigations of technological transitions in other contexts.

The more specific contributions of this thesis derive to a large degree from viewing the GDR case through the twin lenses of culture and technology; a marriage with significant opportunities for academic research applied to a sharply debated history. The GDR is well understood as an ideological and territorial interface, but the specific intersections of culture and technology have not been prevalent among studies to date. Modern technologies and industrial development processes in general were readily integrated into the GDR's strategic program towards a utopian socialist state, arguably giving technological investigative angles a distinct utility here. Indeed, even outside of the specific context of GDR studies technology and technical work is still comparatively rarely examined in politicised circumstances, although this is changing. The technological aspect of the GDR ideological construct was complemented by a similarly deep-seated political emphasis on the societal role of culture. Culture was recruited by GDR planners as a force that could assist the development of a new state and new society distant from capitalist forms and problematic aspects of German history, while retaining some connection to less-contaminated associations of the German past. While the recognition of technology as an analytical framework is developing, the yet-more-specialised area of cultural technologies remains sometimes absent from broader technological discussions that tend to focus on heavier primary industries. The backdrop of the Cold War accelerated the drive for militarised technological advancements, but the stakes for cultural endeavours and cultural technologies were also raised via similar mechanisms and attracted comparable rhetoric. The Cold War served as added incentive for conducting this analysis but it also acted as a reminder that although the processes described in this thesis are culturally-focussed, they were considered central to the GDR project.

Although the detail and focus of analysis of this thesis pertains primarily to the GDR, the methods used here may have procedural usage elsewhere. The findings herein justify the approaches taken by confirming how multi-disciplinary approaches may be suited for surfacing new perspectives and also by suggesting that the uniting of cultural and technological frames may have particular application in areas where there have been contested interpretations. In the pursuit of its goal, this thesis gives some sense of the activities and character of several institutions and actors over significant periods of time, engaging with a variety of subjects that are thematically revealing about a singular entity. This does not equate to a set of complete institutional or biographical histories – the purpose was to bring focus to a number of particularly revealing points that interlink some of the GDR's audio stories. Extensive contextualisation is integrated into this thesis, but neither the material nor the practical limits of this project enabled a fully complete history of any of the cited institutions. For similar reasons, this thesis is not often able to make declarative judgements on specific policy decisions, instead seeking to report and offer interpretations on the material manifestations that emerged from GDR sound infrastructures over stretches of time.

Some of the limitations of this thesis are counterparts to its strengths. It was constructed in large part on a foundation of largely unutilised caches of archival material; the value of this material was recognised early on and required a shift in the overall research approach. As previously stated in the introduction, an early desire was to balance the use of archival sources and preserve a sense of people actively working within the case studies by conducting interviews with contemporary audio workers. Constructing a contextual understanding from the archive sources and forming a focussed research direction was laborious and precluded including interviews in the process – although this would likely enriched both efforts. While the insights and perspectives brought to this material may in part be attributed to coming to this material as an outsider, engaging with the contemporaries of some of the events depicted could have provided a more efficient methodology and it remains possible that the interpretations offered require expanded frames of reference. Testing the findings of this thesis against the reminiscences of those who had experience of the period - while that remains a feasibility - is hopefully an opportunity that I can take. It is also worth noting that the focus of this research is largely limited to the single large cache of material assimilated during one six month period. Only a small proportion of the overall holdings was parsed and little supplemental primary research was possible as the thesis developed with new avenues largely supported by secondary

literature. These authorial and archival checks constrain this project's strivings, but the value of the material unearthed here was evident immediately and this thesis seeks to collate a substantial amount of research work into an accessible and pertinent work.

While this thesis lends its shoulder to the wheel in the progression of some relatively broad areas, its finer contributions are better delineated within the sub-fields encompassed by the various case studies. The sweep of areas covered and angles taken may mean the different case studies have different value for different people; an incomplete list of the topics covered with a degree of detail includes recording studios, concert halls, broadcasting, record industry dynamics and technical research and development processes. Thus, this thesis engages with several sets of interpretative literature and it offers whole or fragmentary contributions to each of these. The value of this research to GDR historians has already been raised and cultural technologies as an avenue within infrastructural studies bears further exploration. The methods and concerns of sound studies have been not been fully applied in this work, but the topics and forms discussed here are well primed for such analysis. Some additional sense of this thesis' overall contribution, along with more specific additions will be laid out thematically below.

6.1 Halls and Walls

This thesis focuses on a small number of case studies, but uses them to extrapolate broader tendencies and alignments within established narratives of the GDR in an effort to investigate the feedback loops between politics, culture and audio technology developments there. The first intuitions that eventually resulted in this research approach were based around the recording studio and an assumption that analysis of recording and performance venues could be instructive about more than just acoustics and technical procedures. The venues of the GDR provided a rich source of interpretation for design and cultural trends but these proved inextricable from political contexts. Several of the case studies here approach various broadcasting houses, recording studios and performance venues and in each case it became possible to point to specific elements that directly related to GDR ideologies or other particularities.

As a chapter, Chapter 1's discussion of Funkhaus Berlin and the situations that formed it perhaps best encapsulates the mission of this thesis through its unification of several seemingly disparate strands in an effort to triangulate a technological structure's deeply embedded position in the GDR's formation. Despite their critical role in the delivery of a new era of mass communication, broadcasting houses have been the subject of surprisingly little investigation or critical interpretation beyond occasional appeals to nostalgia. Radio broadcasting infrastructure in East Germany was highly volatile and bitterly contested during the immediate post war period in ways that are instructive of the times, but also of the forms GDR broadcasting would take. While this chapter probably makes the least use of new research material, its contribution stems from bringing together many sources illuminating different aspects of this structure to construct a new overview of its deep and lasting significance to the GDR's broadcasting infrastructure and national soundscape. The facility's design is noteworthy and the included discussion of preceding events is critical to contextualising how its functional forms were determined. Broadcasting houses and similar period facilities remain in active use across the world, but their encapsulations of particular technological and cultural moments is perhaps better recognised in the US context. Radio City in New York was initiated as a commercial real estate project, but the visible associations its studios and venues carry of a progressive technological vision along with a shared role as an emblem of positivity emerging from the Great Depression are perhaps better integrated into the local general consciousness than buildings which performed similar functions elsewhere. There thus remains considerable scope for reconsidering the roles of broadcasting houses and their studios across Europe and beyond, both in isolation and collectively. Funkhaus Berlin provides an idea of the potential of such investigations.

The Great Hall of the Palast der Republik in East Berlin, introduced in Chapter 4, certainly occupies a different design space to Funkhaus Berlin. It was constructed more than 20 years later and was conceived for a very different set of purposes. Nonetheless, there are resonances in how political contexts were integral to its design motivations and how this can be traced in its final form. This emerges most notably in the unusual conjunction of functions that were combined under the roof of the Palast der Republik and in the Great Hall's diverse performance remit. The Great Hall's technical accommodation for this diversity, especially for sound, placed it right at the edge of contemporary capability and the degree to which its large sound system had an international influence is disruptive of some overriding narratives of GDR

technology. The Palast der Republik regularly provokes positive associations in anecdotal recollections of the GDR, but it remains in many respects under-analysed and especially so outside of its location and architectural form and in the more actively determined context of how it was actually used. This chapter only gives a sense of its formation and early stages of operation, but its design features communicate a lot about the hopes held for its usage and accessibility. Analysis of how its programming developed over time and whether the reception to its acoustic remained stable or altered significantly seems like an investigative avenue that is likely to offer rewards.

The Great Hall's integrated acoustic and sound reinforcement system (DSS) - designed to provide an environment suitable for the relative extremes of both romantic music and popular electroacoustic performances - draws attention to recurring threads of uneasiness in post-war acoustic design and sound reinforcement. During the 20th century there has been steady progress across diverse areas of methodical investigation for uniting qualitative and quantitative assessments of concert hall acoustics and creating more predictable design processes. Despite acoustician's increasing predictive confidence in the decades after the Second World War, the frequency of acrimonious public and critical receptions to prestigious new venue acoustics during this period suggests much remained unreconciled. While one of the lessons of a survey of venue acoustics reception is that the passage of time is an important factor in the development of a generalised assessment, this recurring trend suggests an avenue towards intersections of culture, society and technology that has not been much explored.

Traditional passive acoustics specialised for classical musical performance contexts are not the only forms of performance acoustics with incomplete histories. The utilisation of electronically augmented acoustics for classical music performance has raised interesting anxieties in that field and while electronic interventions are much more readily accepted in popular music contexts, the role and development of sound reinforcement for live concerts and other applications remains weakly historicised outside of specialised technical literature. This thesis alights on these discussions as the specific technical features of the Great Hall place it at an interesting nexus of these areas. Discussing these intersections shows a path towards placing modern acoustic and venue designs within and alongside ongoing social and political historical progressions. The story of the Great Hall and DSS shows the potential rewards for such approaches. In this case, a specialised technical system of little general interest can turn up

surprising findings that transform a local story into an international one that raises significant questions about technology's suitability for particular performance contexts. While the proximity of the GDR's recording and performance spaces to ideological currents helps validate the oblique approach taken here, what is clear is that a lot remains unresolved in the holistic interpretation of acoustics and electroacoustics – both in the GDR and elsewhere.

While it remains difficult or impossible to listen to venues with a historic ear or analyse the soundscape created by sound systems that no longer exist, the fossilised forms of both leave clues enough to make further enquiries worthwhile. The discourse around the acoustics of revered performance venues and their modern iterations is a contested one, yet it remains a peripheral discussion even though it offers up material patterns of listening that can be contrasted between nations and cultures. While there are restrictions to approaches that rely on interpreting physical design, technical papers and contemporary discourse and extrapolating the implications for audiences and performers, some historical interpretation of these issues beyond those compiled by acoustic theorists and informed by a more humanistic bent is justified by the creditable work already undertaken in this area. Such approaches also help restore recognition of the collaborative importance of technology across all forms of performance, particularly those where that role is sometimes downplayed.

Funkhaus Berlin, the Palast der Republik and other GDR venues discussed in this thesis collectively raise important questions about how cultural processes for music recording and performance were conceptualised and how these interacted and contrasted with international practices. These venues and their associated technologies are also helpfully indicative of the general health of GDR institutions and industry. Funkhaus Berlin exposes deep undercurrents of conflict that coloured physical infrastructure development in the GDR, but it also more straightforwardly shows that during the 1950s the GDR had the resources to construct a national broadcasting centre and the creative capability to do so efficiently and with original and effective design features. At a later stage, the Palast der Republik and DSS show that GDR research design groups maintained a degree of vitality through the 1970s and 1980s, sufficient to fulfil its own requirements for a new form of venue and even to develop international commercial aspirations. DSS is also informative for its uniting of GDR conceptual work with practical domestic expertise and for combining GDR-manufactured equipment with the internationally-sourced components necessary to cover the gaps of its own production

capabilities. Other areas of audio technology discussed in this thesis are similarly indicative across multiple levels and time frames of the GDR.

6.2 Format Wars and Desk Jobs

The Cold War has been cited as part of what gives this research significance. It was fought through many proxies and on many fronts and the character of these contests frequently shifted, often due to technological progressions. Such shifts in disposition can be identified in broadcasting changes that took place during the 1950s and 1960s and analysis of these grants insight into how infrastructural strategies were progressed. FM radio had particular significance to the development of broadcasting in Europe during the post-war period. Its technical characteristics greatly improved inter-station operability and reduced the radio airwaves status as an active front between East and West via systemised jamming. In this context its substantially improved audio capabilities were to a surprising extent a secondary consideration. The widespread introduction of stereo several years later was, by contrast, largely only justifiable in terms of its novel audio characteristics. Although this meant the introduction of stereo across Europe was much less contentious than that of FM broadcasting, it still had strategic implications for the GDR albeit in the cultural field rather than in the more fundamental area of the maintenance of an undisturbed broadcasting capability.

Stereo is just a single example of the escalating political necessity in the GDR and elsewhere of providing citizens new technological experiences that were emulative of those being introduced elsewhere in the world. In the 1960s hearing stereo was an important indicator of a living modernity and the infrastructural reconfigurations and resources required to enact stereo in the GDR should be considered in this light. The introduction of stereo broadcasting and records in the GDR again confirms its ability to upgrade and renew its cultural technological systems, while also raising queries about how that was justified and presented to GDR citizens by their government. Stereo is notable as one of many "gifts" bequeathed by the GDR to its citizens in recognition of their collective efforts, an approach to infrastructural development announcements characteristic of the GDR's communication style and paternalistic conception of its citizenry. The introduction of stereo was also characterised, to

some extent, by an informal pan-German collegiality among engineers and planners that contrasts starkly with the contemporary erection of the Berlin Wall.

The unfolding technical narrative of stereo as depicted in this thesis also helps emphasise the degree to which supposedly rigid media formats are actually subject to large degrees of indeterminacy at various development stages. The actions and commentary of GDR technicians confirm that stereo as a universalised format was still in considerable flux even as it was being rolled out across various media. Format changes always raise issues of compatibility and both FM and stereo offered opportunities for the GDR to diverge from Western or internationalised standards. That the GDR across all media forms remained committed to compatibility is comment worthy and should be enticing of further investigation given the divisions in technical standards that were taken in other industries. Of general cultural significance and a useful reminder of the extended negotiations between new and old formats that are sometimes forgotten, the degree to which monophonic recording catalogues retained significance in the GDR and how these were technologically altered to better integrate with the developing stereo soundscape is just one rarely-discussed aspect of mono sound that this thesis raises. Also worth some consideration in the GDR's process of adopting stereo is how it was illustrative of patterns later repeated during subsequent technical upgrades by displaying a combined strategy of tracking and adopting best international practices and standards while simultaneously maintaining an independent research capacity. It was this domestic research capacity that was instrumental to enabling the previously synopsised development of the DSS distributed sound reinforcement system and the ambitious System 2000 project.

Sound desks rarely receive historical attention outside of their associations with particular studios or musical groups, but GDR audio technology systems tie into an intricate national social and political narrative and warranted analysis in this light. Rundfunk DDR's one-off MKR stereo desk bridged an important period for the broadcaster, but probably the most interesting and revealing desk in GDR history was one that never saw active service. The story of System 2000 is thus a very different story than those audio equipment can sometimes accrue whereby a crucial, audible but ineffable contribution is made to a famous recording. System 2000 speaks to much more critical aspects of the GDR audio context. While the world is replete with technologies that had impressive potential but tragically failed to deliver, this

one provides direct access to the most challenging research project undertaken by GDR audio development processes as they approached their unanticipated endpoint.

The research and development process that resulted in System 2000 during the 1980s is notable in and of itself as it was undertaken during a period when Western national broadcasters and record companies had largely ceased to develop their audio equipment systems in-house. That System 2000 incorporated digital elements makes this even more striking as progression in the field of audio automation was often dominated by small independent companies in the US that could exploit the large and diverse output of the US microelectronics industry. System 2000's digital components also bring it into the fold of the GDR's information technology narrative, an aspect of the latter-day GDR that has been relatively well examined. Common criticisms of GDR IT policy include its focus on development for export and its inability to bring promised benefits to domestic industry through improved rationalisation. System 2000 provides a useful complement to these observations as export was initially a distant secondary consideration; it was intended as a practical application of GDR digital technology that would supply demonstrable labour and time savings to the national broadcaster and form the basis of a renewed audio handling infrastructure for the country's venues.

System 2000's protracted and fitful development mean that when compared to international desks under development at the same period, it may have been approaching relative obsolescence even before it was brought into service. However, it had a functional potential for Rundfunk DDR that was thwarted by the repercussions of the fall of the Berlin Wall and the reorganisation of East German broadcasting. In contrast with some of the fatalism that prevailed in some GDR institutions during this tempestuous period, System 2000 workers remained committed to the project despite their recognition of bureaucratic impediments and a rapidly changing market context. The extent to which they completed a sophisticated multi-tiered development project with clear utility for the GDR's sound infrastructures confirms to some degree the resilience of GDR research and development processes during its latter stages, even as supply chain problems with various components hastened the project's failure. It is worth restating that there were precedents for Rundfunk DDR assimilating technological developments within GDR technological frameworks - some have already been raised - and this ability was a major contributor to its expansion and maintenance of a degree of

technological independence. As with DSS, there are some indicators that System 2000 had influence beyond the borders and lifetime of the GDR. While continuing academic analysis since the GDR's dissolution has diversified assessments of the GDR's achievements within its own time period, less thought has been given to surviving influences outwith the GDR itself apart from the lingering cultural attachments alluded to by Ostalgie. A focussed overview of the professional second-lives of specialised GDR technical workers within the audio and software industries of reunited Germany may have important implications for the assessment of its late-stage activities. System 2000 is most revealing in what it reveals about the GDR economy and research processes during a specific historical juncture, but it also raises more internationally-applicable questions on how cutting edge recording practices are disseminated and assimilated across diverse national and political contexts. While the digitisation of audio playback formats and associated impacts on music listening habits and recording practices have been tackled by academia, System 2000 suggest that the early applications of digital technology which are important to these later developments should also receive attention.

6.3 New Interpretations for Old Records

Chapter 2 on the GDR's national record company Deutsche Schallplatten possibly counts as the most original contribution of this thesis by offering an initial interpretation of a new set of data that may be of interest to a relatively wide audience. Deutsche Schallplatten was a major European record label for four decades, but it is uncommon for commercial record companies of similar stature to have publicly accessible records. Increasing interest in the historical dynamics of record production will be well served by continued investigation of this record company's production figures, its technical procurement policies and its commercial relationships with Eastern and Western Europe. In particular, the material narratives of records unravelled in this chapter contribute directly to the expanding utility of music records as a vehicle for new investigations with recent work showing how vinyl records can provide a useful entry point into narratives seemingly outside the remit of a cultural consumable. In this thesis one of the most telling discoveries is how nationalisation processes in the GDR directly and negatively impacted record production during the tumultuous transition from 78s to vinyl records during the late 1950s, to date still one of the most materially significant media format migrations. This changeover moment – exposed using newly uncovered record production

figures – is informative of GDR processes and industrial resilience at this point of time, and there is scope for seeing whether the 78s to vinyl transition might also be instructive in contexts outside of mainstream European and US discourses.

One of the most common observations of the GDR's record industry is how records were priced; from very early on in its existence classical music releases were subsidised and popular music recordings were consistently the most expensive. Motivated by an underlying ideological belief in the catalysing social power of classical music and the comparative degeneracy of popular music forms, the strength of this doctrine is made explicit by a long term policy of maintaining pressing standards for classical music records at the expense of non-classical pressings. Popular music in the GDR was undoubtedly the recipient of some privative treatment but it was steadily better integrated into Deutsche Schallplatten's overall business model as time progressed. Deutsche Schallplatten's comparatively limited support of popular music production during the 1950s and early 1960s payed increasing financial dividends as the domestic and international markets for GDR pop acts developed. Indeed, a consideration of the differentiated roles of the GDR's popular and classical music labels is crucial to understanding how Deutsche Schallplatten was able to carve out a sustainable business model by positioning itself astutely between its domestic and international markets. The company's prestigious classical music assets and good relationships with West German and international record companies helped launch the company and maintained a cash flow of hard currency from abroad that was funnelled towards meeting production and equipment needs that were used for making records across all its labels.

Deutsche Schallplatten perhaps did not attain powerhouse status comparable with some of its West German counterparts but its prestige and output were in reasonably good alignment with the GDR's musical reputation and population base and it became one of the GDR's better recognised organisations abroad. This was a serious achievement. The large West German record companies had decades of experience, extant plant and recording facilities as well as established patterns of distribution. Deutsche Schallplatten, by contrast, was in essence an entirely new record company that had to develop a production base from scratch and establish an identity just as the GDR was beginning to solidify into a stabilised nation. It was able to meet these goals due to a keen understanding and focussed exploitation of its market position and it navigated several incredibly volatile periods before maintaining several decades of

sustained incremental growth. Unlike some vulnerable areas of GDR industry, Deutsche Schallplatten's model in the period preceding the fall of the Berlin Wall appeared stable and it had begun the initial stages of transitioning to CDs as the next dominant music format. Finally, Deutsche Schallplatten's recording catalogue, both classical and popular, continues to be re-mastered and re-released, providing a continuing GDR narrative of note that attests to decades of cultural activity only partially accommodated in post-Wende Germany.

6.4 Future Ends

This thesis discusses sound technology infrastructures constructed in the GDR and queries the degree to which political and other factors interacted with their development and form. The path towards this endpoint has been described and while untangling this intersection of areas was difficult, it is the task of historians to describe narratives crowded out by more dominant histories. The GDR certainly represents a technological other despite its proximity to key European post-war dynamics and this research project brings to light new elements within established GDR - and perhaps broader - technical and cultural narratives. This is not just a narrative of technological components and procedures – it also about a people and their society and how they used audio technologies to construct their lives. This thesis originally sought to centre itself on people and their activities and while the broadening of the scope of this thesis placed people at a greater remove from its central investigations than was originally intended, it avoids an overly deterministic view by implicitly recognising the intermixture of human effort and various forms of physical material necessary in infrastructural formations. This thesis attempts to enact its recognition of this by placing technological and infrastructural developments within broader historical narratives and by making a case for the utility of cultural technologies as a point of analysis in wider political narratives. For its contributions to knowledge and for raising multiple opportunities for continued research, this thesis likely warrants wider publication. Although each of the case studies stands on its own, the character of the interactions between cultural technologies and the GDR emerge most effectively across the studies and they would likely benefit from being published together.

The missed opportunities in the collation of primary sources previously described also represent openings that can be returned to; most notably seeking GDR audio workers who are

willing to shed further light on the findings of this work. Workers from the RFZ research organisation mentioned repeatedly throughout this thesis represent prime candidates for such efforts, as the RFZ links nearly all the cases in this thesis. Although a small organisation with limited resources, it was capable of envisioning practical and radical research directions for the GDR over a substantial period of time. A more comprehensive history of this organisation would intersect across a multitude of dynamic areas, including the many semi-nationalised audio electronics and sound equipment manufacturers of the GDR not discussed in great detail here. Other than the RFZ, the most apparent future research directions raised by this research work have been suggested in the course of this conclusion. However, I also recognise that this work centres on a very specific central European context and relies heavily on US and UK comparators – similar investigations conducted outside of these culturally dominant spheres and incorporating more diverse realms of contextualisation demand consideration. As a final note on future directions, the role of women in the GDR is an area that has been investigated adeptly and been considered one of the GDR's more substantial implementations of its own purported values. The primary sources used to drive this thesis convey enough to confirm that there were interesting gender dynamics in the GDR's record and broadcasting industries, but offer only enough firm detail to allow the inclusion of some minor anecdotes here. This suggests a major limitation of these archival sources and again demands paying attention to the memories of GDR audio workers, most pressingly those women who worked as audio technicians and sound engineers within Rundfunk DDR and Deutsche Schallplatten.

In summation, these case studies demonstrate that throughout its existence the GDR maintained an active process of technological renewal to both create and enhance audio-based cultural media infrastructures. Over a broad period, this process was characterised at first by attempts to renew stalled pre-war processes and damaged infrastructures and later by attempts to create independent infrastructures disentangled from pre-existing pan-German infrastructures or created anew within GDR ideological frameworks. Alongside this internal dynamic, the case studies of this thesis straddle both sides of the emerging technological progressions that defined the second half of the twentieth century. Despite economic and political challenges, the GDR's resources and research capacity were able to maintain a reasonable level of parity with the West in technological areas that were developed before the war and which matured during the post-war period. The period of relative optimism experienced by the GDR in the 1960s, accompanied by the introduction of such developments

as colour television and stereo radio transmissions, can be attributed to some degree to the legacy of the refinement of this era of technologies. A development gap soon became more apparent in the area of technologies which emerged after 1946. The steady impact of the transistor and other microelectronics is key to understanding shifts in the GDR's capacity to innovate in its latter decades, although developments in petrochemicals and in other areas were also impactful to audio infrastructures. The GDR's ability to maintain pace with the West in a technological era driven by vacuum tubes and electric motors was creditable, but proved immensely more challenging in a time of microprocessors and plastics. While failure is a recognisable thread throughout these case studies, so too are many notable and mundane successes. These often balanced exigency, pragmatism and ideology in ways that are inimitable outside of the GDR's particular circumstances.

Primary political drivers in the GDR were the common ones: providing food, work, transportation, entertainment. Improving technologies and infrastructures facilitated the provision of these essentials but also provided the promise of more. The GDR made many promises to its citizens and in the long run it famously failed to deliver on some of the most fundamental of these. This has been well documented, but this should not prevent additional considered analysis of the other explicit and implicit compacts it entered into and how its unique circumstances filtered into the forms of its cultural technologies. It is hoped that the snapshots herein prove provocative and indicative of areas clearly worthy of continued study and better incorporation into wider German and European narratives.

Appendix 1: Glossary of Terms

Amiga	Popular music sub-label of Deutsche Schallplatten
Deutsche Post	GDR national postal and telecommunications service
Deutsche Schallplatten	National record company of the GDR, founded in 1953
Eterna	Classical music sub-label of Deutsche Schallplatten
Funkhaus Berlin	Main radio broadcasting house of the GDR built in 1952
Haus des Rundfunks	Berlin radio broadcasting centre, built in 1930
Hörgruppe	Critical listening group active within Rundfunk DDR
Lied der Zeit	East German record label founded in 1946
Palast der Republik	Palace of the Republic. East Berlin civil and cultural centre opened in 1976
Rundfunk DDR	Radio GDR. GDR's national radio broadcaster, active from 1952
Rundfunk im amerikanischen Sektor	Radio in the American Sector. US-supported broadcaster based in West Berlin, active from 1946
Sendesaal	Radio broadcast Hall
Tonmeister	Sound Master. Senior sound engineer
Wende	Period incorporating the reunification of Germany

Appendix 2: List of Abbreviations

BRF	Betriebslaboratorium für Rundfunk- und Fernsehen (Operations Laboratory for Radio and Television). Technical research group for Deutsche Post in the 1950s, subsequently reorganised and renamed as the RFZ
Comecon	Council for Mutual Economic Assistance. Cold War era economic organisation formed by the Soviet Union
DDR	Deutsche Demokratische Republik (German Democratic Republic).
GDR	German Democratic Republic. The state founded in 1949 from the Soviet-controlled Eastern Sectors of occupied Germany and Berlin
NSDAP	Nationalsozialistische Deutsche Arbeiterpartei (National Socialist German Workers Party)
RFZ	Rundfunk- und Fernsehtechnische Zentralamt (Central Radio and Television Technical Department). Successor to the BRF, active from 1961
RRG	Reichs Rundfunk Gesellschaft (Reich Broadcasting Corporation). Germany's first national broadcaster, founded in 1925
SED	Sozialistische Einheitspartei Deutschlands (Socialist Unity Party of Germany). Ruling party of the GDR.

Appendix 3: Conference Papers

'Singing Across the Wall: The Voices of Nina Hagen'. Paper presented at the Music and Sound Studies Network of the German Studies Association conference, Kansas City, 20 September, 2014.

'Recording Studios in the GDR'. Paper presented at GDR Today II, University of Bristol, 10 September, 2015.

'The German Democratic Republic and the introduction of Stereo'. Paper presented at Music PGR Research Symposium, University of Edinburgh, 18 May, 2016.

'Saal I, Funkhaus Berlin'. Paper presented at the Music and Sound Studies Network of the German Studies Association conference, San Diego, 1 October, 2016.

'Space, Sound and Technology at Rundfunk DDR'. Paper presented at GDR Today III, University of Bangor, 6 April, 2017.

'Space, Sound and Technology at Rundfunk DDR'. Paper presented at Music PhD Symposium, University of Edinburgh, 12 June, 2017.

'Recording Spaces, Technology and Vinyl Records in the German Democratic Republic'. Paper presented at Alison House Research Seminar, University of Edinburgh, 29 March, 2018.